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ELECTRONIC DOCUMENT SUPPLY
THE INTERNET
DESIGNING INFORMATION PRODUCTS
INFORMATION FOR ENTERPRISE

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Aslib, The Association for Information Management
Information House
20-24 Old Street
LONDON
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Agents for electronic document supply: who are the likely players?

Dorothy Day, Geoff McKim, Douglas Orchard, April Purcell, David Wachsmann, Elisabeth Davenport
School of Library and Information Science, Indiana University, Bloomington IN 47405

Abstract
The authors consider a group of commercial vendors who may be potential agents or players in electronic document supply. The group examines five potential providers of products/services: Dow Jones, Geac, OCLC, Faxon, RLG using Malone's 1989 comments on electronic markets as a framework, and using Porter's analytics to describe competition, and the role of technology in conferring advantage. The authors suggest that electronic document supply has produced an observable shift in exchange relationships between suppliers and buyers: the former are regrouping into partnerships which offer a confusing range of options to clients.

Introduction

Malone *et al* writing in 1989[1] describe in broad economic terms what happens when a new and wide-reaching technology impacts a particular industrial sector. They assert that in many cases networks may induce shifts from one to the other of two main market patterns: hierarchies, which are vertically integrated, and firm-based and characterize supplier-buyer relationships of one to many; and markets, where buyers must choose among many diverse and competing producers. The patterns of transformation will not be uniform; different ones apply in different sectors, but the authors predict that the overall trend will be toward value-added partnerships and market exchange mechanisms. This environment will require agents who can advise consumers, offer some degree of quality control or advice, and ensure that choice is made between viable alternatives.

The authors of this paper were involved in a three month project to explore what a consumer (individual or institution) might need to know to make an informed decision about sources of information on electronic document supply, what kinds of agents might offer intelligence (to aid their choice) and which document delivery services were currently available. The group looked at several areas – producers, serials agents, document supply centres, technical standards, legal issues, economics, and consumers and, over a period of ten weeks, compiled a resource base using various sources – Internet, serials, grey literature, local knowledge (on the Indiana campus), company information[2]. It became clear that although there is much speculation about what the markets for networked electronic publishing might look like, no uniform models for pricing or management have emerged. The commercial sector's pilot projects are partial and/or variants of parallel publishing (that is, the electronic transmission of text which has been prepared for traditional formats); and the libertarian environment which characterizes e-journals on the Internet offers as many examples of practice as there are journals.

The group identified at least three scenarios for electronic document delivery which reflect different levels of development (or, inversely, risk aversion). The first is the use of networks to improve or make more efficient existing processes: EDI (electronic data interchange) for example, to link publishers and serials agents and libraries, or fax delivery of individual articles. In the second scenario publishers offer access to digitized copy on demand to researchers, at prices which have been contracted by agreement with individual institutions – this scenario is manifest in pilot projects like Elsevier's TULIP[3]. The third scenario is the totally electronic production and dissemination of research material through e-journals which bypass traditional agencies (publishers or mediators) and are moderated by researchers within the confines of relevant subject groups through listservs. (For the purposes of coherence of comparisons, the authors are excluding bulletin boards and conferences from the remit covered by the term 'document delivery'). Many commercial publishers participate in the first scenario; a few (the larger ones) in the second, and none in the third though there is considerable activity among not-for profit learned societies in this area[4].

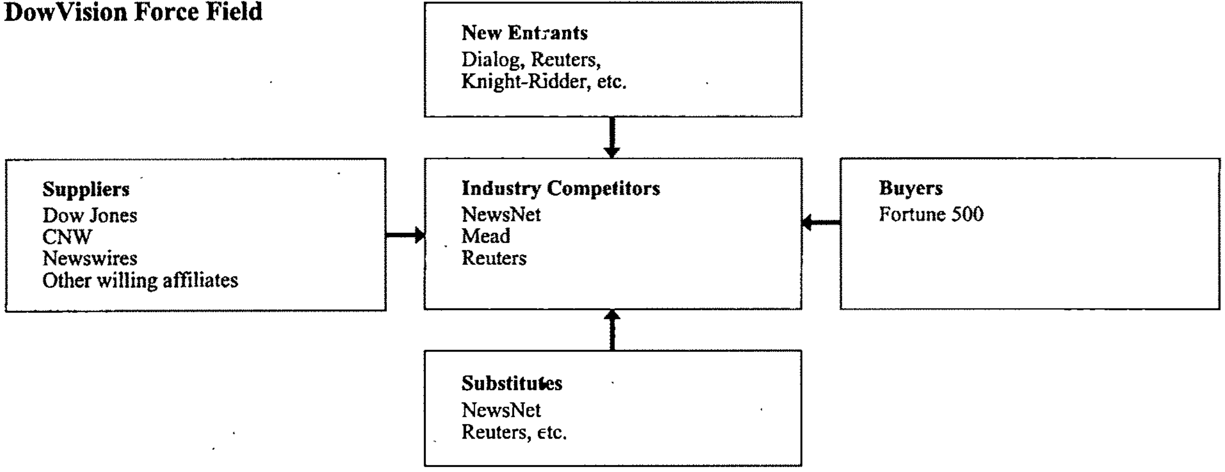
In the text which follows, each author describes a service (or range of services) offered by a potential player in the area of electronic document supply, to try to assess which of the existing commercial operators are likely to act as agents on the networks of the late twentieth century. The group were primarily interested in new entrants who might compete, or cooperate, with existing major players: UMI and the British Library Document Supply Centre are thus mentioned only indirectly in the text which follows. To facilitate the discussion of points in common, each author followed (more or less) the same blueprint: an introduction and justification of the chosen player, an analysis of the industrial position of that player using Porter's five force field and value chain. The five force field maps the position of a particular player in an industrial sector in terms of existing competition, supplier power, buyer power, threat of new entrants and threat of replacement products (see Exhibits 1-3); the value chain maps the benefits of technology investment across a firm's operational units (see Exhibits 4-6)[5]. Each author also performed a content analysis of the literature through which the player represents itself and its product(s) to the public, and made observations on the player's likely future position in the sector (based on statements of intent in annual reports etc.)[6]. The five product groups are Geac's 'total solution' to library automation, Dow Jones' DowVision gateway/continuous stream service, RLG's product/service suite (RLIN, Arlen, Citadel), OCLC's products suite, and Faxon's subscription service.

Dow Jones' DowVision

Dow Jones and Company publishes business and financial news. Dow Jones had a 1992 revenue base of 1.725.1 million[7]: Information Services accounted for 58% of that revenue base, business publications for 32% and community papers, 10%[8]. Dow Jones offers a range of services, each of which offers a different way to distribute roughly the same information: the News Retrieval, for example, is offered via a modem; Journal Finder, however, requires the client to call a 1-800 number and the operator will perform a search through Dow Jones publications for the client, and either mail or fax the information. In 1990, Dow Jones launched DowVision, a product that 'will play an

Exhibit 1

DowVision Force Field



Geac Force Field

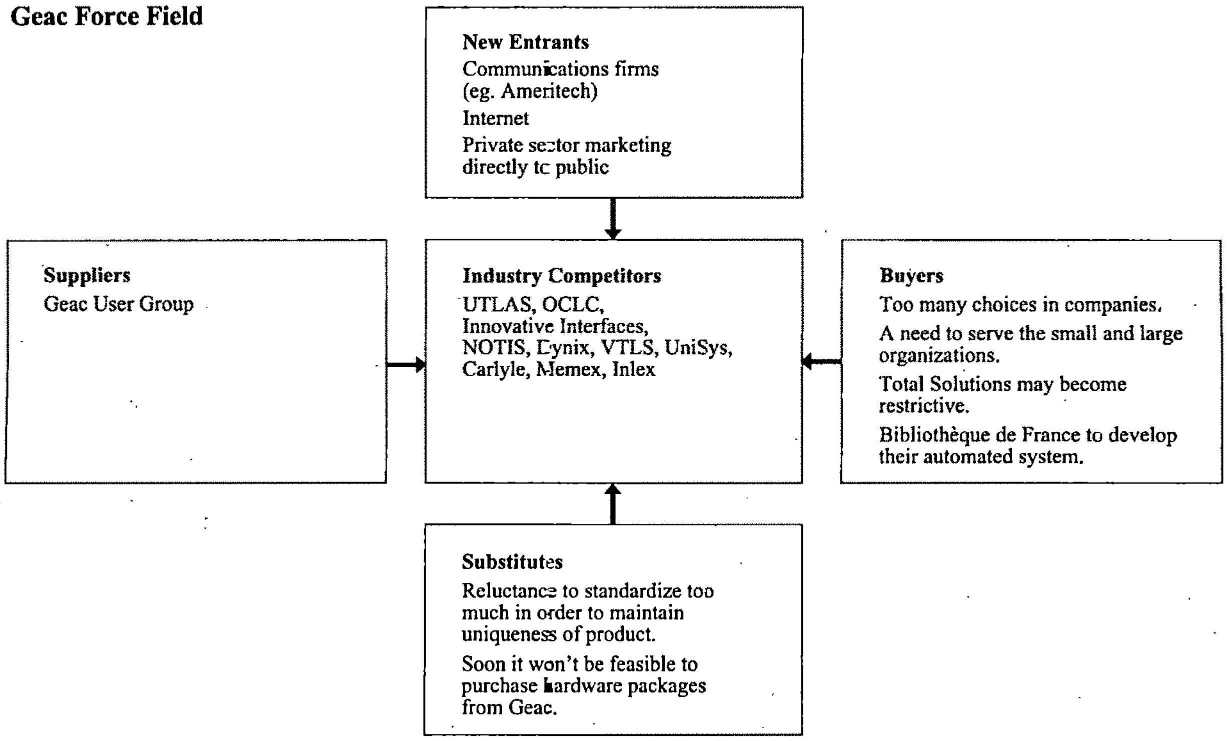
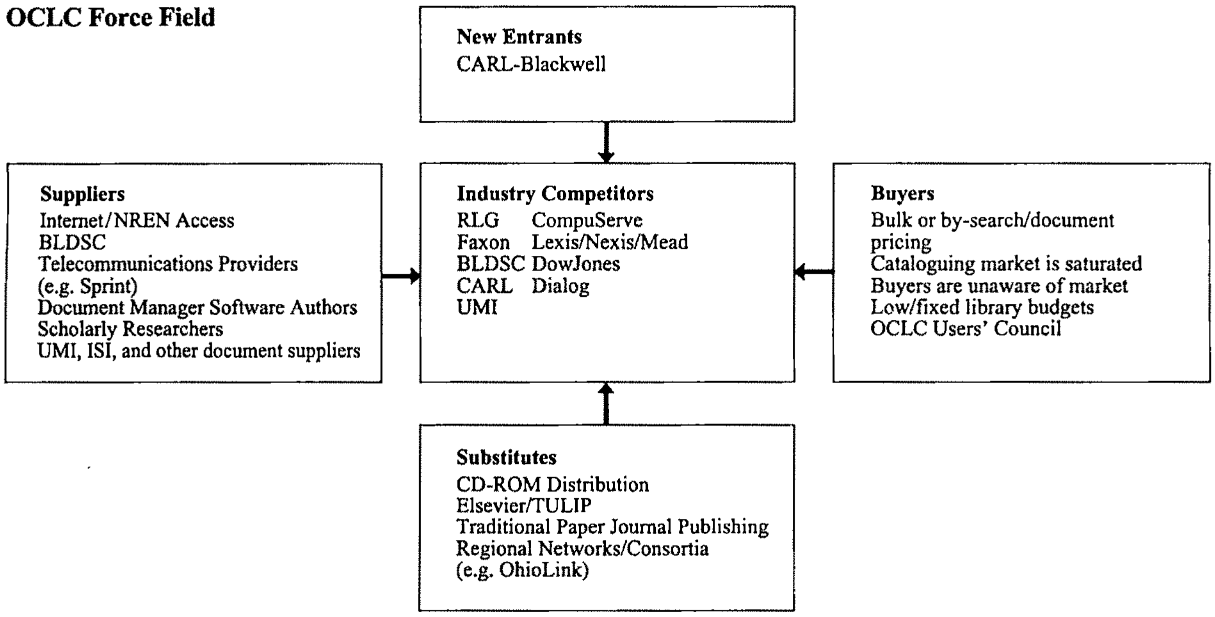


Exhibit 2

OCLC Force Field


New Entrants
CARL-Blackwell
Suppliers
Internet/NREN Access
BLDSC
Telecommunications Providers
(e.g. Sprint)
Document Manager Software Authors
Scholarly Researchers
UMI, ISI, and other document suppliers
Industry Competitors
RLG CompuServe
Faxon Lexis/Nexis/Mead
BLDSC DowJones
CARL Dialog
UMI
Buyers
Bulk or by-search/document pricing
Cataloguing market is saturated
Buyers are unaware of market
Low/fixed library budgets
OCLC Users' Council
Substitutes
CD-ROM Distribution
Elsevier/TULIP
Traditional Paper Journal Publishing
Regional Networks/Consortia
(e.g. OhioLink)

Faxon Force Field

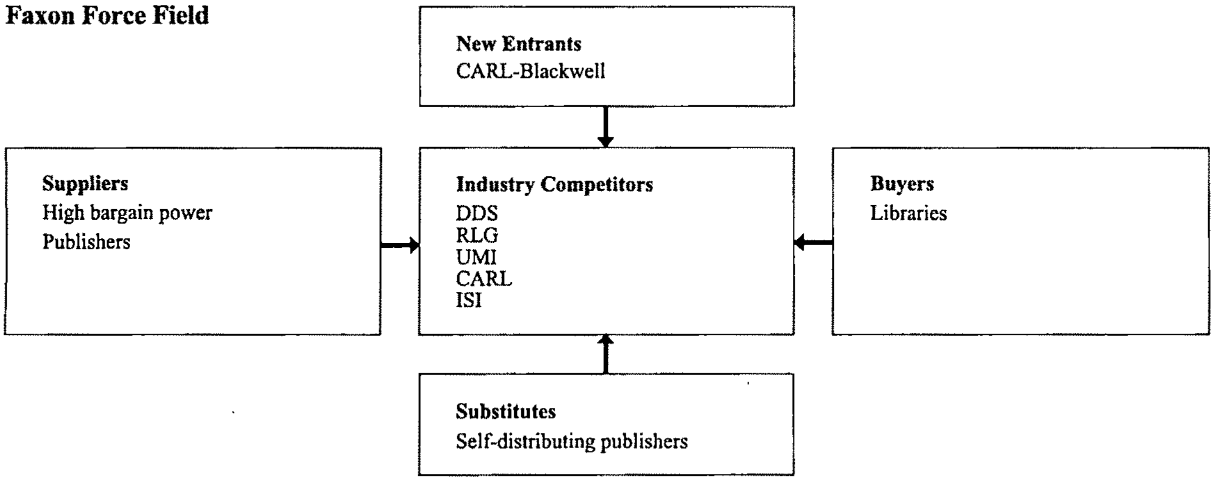


Exhibit 3

RLG (CitaDel & Ariel) Force Field

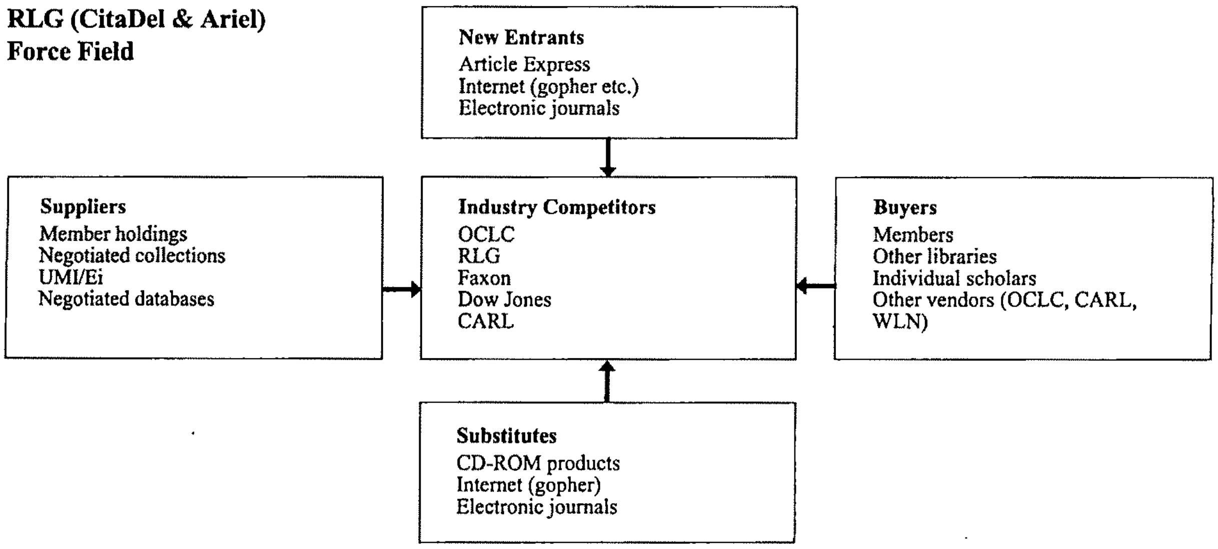


Exhibit 4

DowVision Value Chain

Inbound Logistics	Operations	Outbound Logistics	Marketing & Sales	Service & Support
Manufacturing of other services • paper • printing • etc. Reporters Complete vertical chain Vendors News reports processed and unprocessed	Proprietary news from DJ & other sources Network delivery systems Broadcast server Interactive Server Alliance Developer Program	Wall Street Journal Dow Jones News Service Capital Markets Report Dow Jones International Service Federal Filings Business Wire PR Newswire Canada News Wire	Leveraging existing markets Tradeshows Conferences Dow Jones Publications Formal Marketing	DowVision

Geac Value Chain

Inbound Logistics	Operations	Outbound Logistics	Marketing & Sales	Service & Support
Librarians employed in development and management of systems Reinvestment of 17-18% of gross annual revenue in research and development Inexpensive purchase of assets	Expertise in wide variety of systems Diversification from mainly hardware to hardware and software, emphasizing software	Turnkey systems UNIX-based open systems Sales or rentals of systems	Geac software's abillity to run on other vendors' hardware 'Total Solutions supplier': hardware, software, supplies, support, communications professional services Focus on product and marketplace Value of customers Hardware for large libraries Software for medium libraries	Service personnel able to repair Geac hardware and other vendors' hardware Training and education programs Service units located in Central and Pacific Time Zones Service, mainenance support Network planning and design

Exhibit 5

OCLC Value Chain

Inbound Logistics	Operations	Outbound Logistics	Marketing & Sales	Service & Support
Member organizations Document Supplier / Resource Center Program Negotiated Contracts with supplier / competitors (ISI, UMI, etc.) Telecommunications (Sprint)	Reference Resource Sharing Telecommunications access / networking Online Union Catalog maintenance Cataloging Research Electronic Publishing	EPIC FirstSearch PRISM ILL Subsystem Regional Networks (e.g. INCOLSA) OCLC Dispatch Service Online Journal of Current Clinical Trials ArticlesFirst & ContentsFirst	Regional Networks OCLC Newsletter OCLC Research Distinguished Seminar Series OCLC LISTSERV Advertising in Library Journal, Online, American Libraries, etc.	OCLC Technical Bulletin 800-number technical support

Faxon Value Chain

Inbound Logistics	Operations	Outbound Logistics	Marketing & Sales	Service & Support
Publisher relations: • claiming • gathering • merges • supplements • suspended pubs. • format chgs. • numb. chgs. • price chgs. • ceased pubs.	• Software design • Database production • Research • Document scanning & faxing • Dbase mgmt. • Software maintenance • coop. ventures	Order process. • billing • payment • renewals • claiming Client status reports	Salesforce Market research Conferences	Systems Representatives Training

Exhibit 6

RLG Value Chain

Inbound Logistics	Operations	Outbound Logistics	Marketing & Sales	Service & Support
Member holdings UMI/Ei etc. databases Museum archives Legal archives Member advisory groups Products of own task forces	Basic collection access and delivery service RLIN Cooperative preservation microfilm projects Serials Access Initiative Tasks forces and committees Memberships in other scholarly organizations International ties	CitaDel, Ariel, ShaRes Preservation Reformatting Information Service Archives & Museum Information Systems Rigler & Deutsch Record Index Inventory of American Sculpture Short-title catalogs Databases on CD-ROM	Comprehensive Appeals to niche markets Services to independent scholars Price restructuring CitaDel fixed-fee service and low-cost document delivery Ariel (ILL tool) to deliver documents Advertising: low-profile – scholarly publications, academic conferences, trial database use	Member communications: *Colloquium* (newsletter) Member advisory groups Online conferences: CONFER PREFIS ARIE-L User-friendliness of products Membership decision-making Elective governing board

increasingly important role in the 1990s and beyond in meeting the information needs of businesses around the world'[9]. The investment it has made in the product is significant: DowVision apparently intends to position itself for presenting real-time information through document supply.

Input into this product includes both the manufacturing and service sectors of Dow Jones. Before the *Wall Street Journal* is printed, or the service sector creates its databases, '900 business journalists around the globe in eleven news bureaux in the US and 34 foreign cities create the news'; Dow Jones differs from many vendors in that it creates news products as well as distributes them.

The DowVision product involves five areas of operations: proprietary news from Dow Jones and other sources; network delivery systems; a broadcast server; an interactive server and a development program with allied software developers. An X.25 packet-switching network serves as the central hub for DowVision services; currently, the service has 13 nodes (twelve in the US, and one in London); each city node is connected with the central 'hub' by the 56 kbs per second connection circuits; the clients are then connected to the nearest city node by a 9.6 kilobyte tail circuit[10]. The broadcast server puts all of the nine services into a central file, and shoots a composite feed to the Clients' servers. DowVision also contains an interactive server, which provides access to full text articles from over 13,000 newspapers, magazines, business publications and newsletters. Although the complete News/retrieval service is not offered at present, more will be included in future[11]. DJ does not develop software in-house to permit the Client's hardware to work with DowVision. Instead it has built an alliance with the following software developers: American Real-time Services, Desktop Data, GESCAN International, Verity, and Reach Inc. Each of these focuses on a particular area, or has a history of expertise in a desired area that can enhance Dow Vision. For example, GESCAN has a history of providing realtime news and message handling systems to federal government agencies[12].

Dow Jones proposes to follow a loss-leader strategy in pricing DowVision[13]. Access is offered as a flat fee which is comparable to the price of a subscription to the *Wall Street Journal:* for 1000 users, DowVision costs $12 a month, which provides access to the *Wall Street Journal, Dow Jones News Service, Capital Markets Report, Dow Jones International News Service, Federal filings, Business Wire, PR Newswire, Canada News Wire* and part of *Dow Jones News Retrieval Service.* The product will be piggy-backed with other products to existing clients. Potential competitors are numerous: Knight-Ridder, Mead, Reuters, News Net can all come up with a similar system; and this competition is what drives DJ to improve its services, keep its prices low, and come up with innovative products like DowVision. If and when competitors catch up and also provide a continuous service like DowVision, the actual supply of documents (accessible resources) may become an important factor. Dow Jones have targeted DowVision at the desktop computer, to provide news directly to the deskworker by bypassing corporate libraries or clippings services[14]. DowVision was recently launched in Europe, as part of Dow Jones' global strategy to provide information however, whenever, and wherever our customers want it: 'in addition to serving new customers in Europe, we can also provide DowVision to our US Customers who are requesting our real-time news in their overseas locations'[15].

If DowVision is a flagship product for electronic document delivery of a highly successful and richly endowed corporation, what features can we earmark as standards for the future? Distributed supply, conformance with network standards, third party develop customized front ends, desktop delivery, development from an existing customer base. These are included in the comparative table in Exhibit 1.

Geac's total solution

Geac Computer Corporation Ltd designs, manufactures, sells and services computer hardware and software packages to selected vertical markets including libraries, financial institutions, and commercial systems. Although Geac is not currently a major player in electronic publishing, it is a key provider of computer automation services to large academic libraries. Since such libraries are one possible venue for electronic publishing and networking, Geac could become strategically important in linking libraries with new methods of document supply. Geac markets itself as a 'total solutions' supplier, meaning that it can provide everything a library needs to become automated including software, hardware, supplier, support, communications, and professional services[16]. Geac's recent objectives have been to establish computer packages in as many locations and markets as possible, and to acquire other companies with like markets. The company has made advances, moving from systems that can only be supported by their own hardware to systems that can be run on other vendors' hardware as well. At this time, a main focus of company activity is marketing and service ('Geac users have power in numbers'[17], and a commitment to UNIX-based open systems. All of this is supported by the service division, which offers training and education for new users of Geac systems and support networks in both the Central and Pacific time zones.

The company now emphasizes software as much as hardware, expansion of service to include other vendors' hardware, and innovative products like SynreVoice (a voice-activated telephone informing service for libraries), Image Power ('a PC-based image management system that is designed to catalogue image collections and to store them on a variety of media including optical drives'[18]), and DataWay, an X.25 gateway for increased data communications. Companies Geac has acquired since 1992 include CLSI, ALII, Albion Computing Australia, J&E, Fact International, NBI Canada, and McDonnell-Douglas Information Systems – many of these are small companies located in areas in which Geac wants to increase its holdings: Canada, the US, Australia and the Pacific Rim[19]. By acquiring a smaller company that often has been serving small companies, Geac expands its opportunities in that sector. Although Geac representatives have been present at meetings with their competitors in library automation at which connecting with the Internet has been discussed, there has been no indication that Geac is interested specifically in developing links with the Internet for its customers[20].

Geac has a solid customer base internationally because it has automated many major libraries including Princeton, the Bibliothèque Nationale and the Library of the House of Lords. Current competitors include UTLAS International, Innovative Interfaces, NOTIS, Dynix, UniSys, Memex[21]. Other competing firms in this market are also forming links, either through acquisition, as with Ameritech's acquisitions of Dynix, or by merging with smaller firms. A new entrant like Ameritech can provide the fiber-optic technology necessary for network linkages, and the competitor company Memex proposes to offer an NREN Gateway Service, which 'will provide any library, for a single annual fee, equipment and guidance for navigating the Internet today, and support for future NREN applications as they develop'. In spite of Geac's claims in company literature to offer 'Total Solutions' to clients as a reliable 'technology partner' are undermined by such activities on the part of competitors[22].

Although Geac has not shown evidence of concern with the future of electronic publishing and document supply in libraries, that may be because few libraries are concerned enough about this issue to pressurize the company. Geac has shown initiative in its work with technical standards, and it is possible that this work will naturally lead the company into more involvement with electronic publishing, eventually bringing electronic publishing to libraries. However, Geac's messages to libraries do not specifically address the technological changes contingent upon moving into electronic document supply. Instead, Geac is, albeit obliquely, sending out signals about the dangers of direct supply to the individual user[23]. If Geac is anxious to remain strong in its market, it would best do this by expanding its view of the needs of customers beyond total solutions, especially in the library market, to truly envision a 'library without walls' and the kind of consumer power such an entity would have.

Geac's strategies have little in common with those of Dow Jones; compliance with standards, and (in principle) commitment to a distributed environment (via the UNIX emphasis) apart, the company caters for an institutionalized clientele and specifically disassociates itself from desktop delivery, and provides software for a range of hardware (rather than relying on third party developers); if it did move into document supply, it would perhaps be on the basis of enhancing its existing customer base.

OCLC's reference services

OCLC, the Online Computer Library Center, was originally formed as a consortium of Ohio libraries sharing an online catalog; it is currently a tax-exempt, not-for-profit corporation as defined in Section 501(c)(3) of the Internal Revenue Code of the United States. This status does not mean the OCLC does not or cannot make a profit, but that such profit cannot be distributed to its members, except as fair compensation for services rendered[24]. In addition, it must maintain an exclusive mission of enhancing public welfare, in the form of education of the public, a requirement that is more precisely documented in Section 501(c)(3).

OCLC sees itself currently as being composed of three primary, or 'core', businesses, along with several secondary businesses. These core businesses are cataloguing and resource-sharing, which are traditional OCLC strengths, and reference, a business which

OCLC is presently attempting to build and strengthen. It appears that the reference business, along with parts of the resource-sharing business, offers OCLC their greatest opportunity to expand into the document supply industry. 'Reference' as OCLC uses the term, seems to refer to almost any full-text, article, or document-based online information; company documentation advertises that 'whether you or your patrons need a citation, an abstract, a document, a journal article, or just a quick answer to a simple question, reference services allow you to be a more responsive information center[25]'. Reference Services are based on two major systems: EPIC and FirstSearch, with a variety of other subservices available through one or both of these. EPIC is targeted to the information professional or librarian, while FirstSearch is aimed at the end-user or consumer of the information. Document supply has emerged as a significant part of the resource-sharing business: 'resource sharing will move beyond bibliography and interlibrary loan to include physical document delivery and electronic publishing[26]'. In a sense, document supply is a means to an end for OCLC, with reference and resource-sharing as the ends. OCLC literature, however, shows it to be a strategic means.

OCLC is also moving into the area of electronic publishing. The *Online Journal of Current Clinical Trials* began electronic publication in 1992, with the American Association for the Advancement of Science providing editorial content, and OCLC providing the electronic compilation, publishing and delivery capabilities; this has been followed by a nursing e-journal scheduled to begin production in the upcoming year. OCLC, however, is not seeking to usurp the role of the traditional publisher – rather its aim is to speed access to information, and in particular information in the scientific, technical, and medical fields. OCLC leverages their technical capabilities, including telecommunications access and bibliographic access, while leaving the editorial content up to the strategic partner(s). The CORE project, a partnership between OCLC, Cornell University, Bellcore and the American Chemical Society is a further example of this principle in action[27].

OCLC is a corporation that lives with a split personality; it seems to see itself in two different roles, that have the potential to take the company in divergent directions. OCLC portrays itself alternately as a member-based consortium, dedicated solely to the public good, and as a corporation needing to compete. Much of OCLC's language with regard to competition and strategy may appear to be at odds with its benevolent public purpose. The following are presented as corporate risks: 'Increasing government role in providing telecommunications and information services that duplicate OCLC's' and 'Decreasing community support for the principles of cooperation, resource sharing, and collaboration'[28]. In a recent strategic plan, OCLC states that they intend to 'forge information alliances with other organizations to develop new reference products and services that OCLC could not do by itself[29]'. Hence the strategic partnerships with learned societies, and funding for research conducted at universities and other research centers (including some that may appear to be competitors, like Faxon or SilverPlatter)[30] OCLC Dispatch Service, the new end-user document delivery service (delivered via US Mail, courier, or fax) available through FirstSearch and EPIC, provides documents supplied by both UMI (Article Clearinghouse), and the Institute for Scientific Information. These companies are in competition with OCLC as well, offering their own document supply services. OCLC has also been working with Faxon, probably one of their key competitors in the document supply arena, to try to add them as a supplier.

OCLC leverages all of these paradoxes (partnership/competition and public consortium/corporation) to its own competitive advantage. Though it forms partnerships with document suppliers who also have their own independent document supply services that can compete against OCLC's, it adds value to them through several means: it provides bibliographic access to such documents, and by bringing multiple suppliers together, provides a uniform interface to a variety of document suppliers through the already popular FirstSearch. More significantly, OCLC gains competitive advantage in the document supply industry by giving users a choice of suppliers for a given document, allowing them to seek the lowest price. OCLC competes on the basis of being able to act as an intermediary, an access mechanism, for a variety of online information resources and documents: some of the suppliers of some of these resources and documents provide competing services, and some of the items that access is provided to belong to other member libraries through the Inter-Library Loan system. Thus OCLC's not-for-profit corporate status and library-centred service orientation allow it to be the backbone of a national resource-sharing effort (the Inter-Library Loan subsystem), a status that it then utilizes to compete further in the market.

One of the clearest trends that one can see in OCLC's move into document supply is the trend towards marketing more information and services towards end-users. The introduction of FirstSearch, the inclusion of OCLC Dispatch Service and patron-generated Inter-Library Loan requests into FirstSearch, and statements like 'From his or her workstation, the scholar will communicate with peers, consult databases, transmit or analyse large quantities of data, and manage personal libraries'... all point to the same direction[31]. An important feature of such services is integrated document delivery. A recent annual report states the 'new platform will eventually combine searching, interlibrary loan, and document delivery in a single service for fast, low-cost resource sharing'. Even though document supply is not a core business of OCLC, it is a de facto virtual business, cutting across their other businesses.

What does OCLC have in common with the other firms reviewed so far? Their strategy of marketing of services and documents to the end-user desktop is very similar to that of Dow Jones, but distinguishes them from Geac. OCLC also bases much of their strategy on alliances and joint ventures. Finally, OCLC, as does Geac and Dow Jones, leverages an existing client base to make their services even more useful and marketable to additional clients.

Faxon's service suite

The Faxon company is a subscription agency that specializes in developing software, creating databases and delivering documents to the library community. The company has developed comprehensive systems to manage every facet of the library's serials; in 1992, annual sales totalled around $505m. The company is involved in research (through the Faxon Research Institute) which will allow it to 'actively figure out how to make our services obsolete. Because if we can't someone else will'[32].

Technology lies at the back of Faxon's business, and the company has proved innovative in its application of EDI in 1991. EDI's role in the company's value chain demonstrates its success as a lever of competitive advantage: at the inbound logistics end of the chain (relations with publishers) publishers who have agreed to conform with the X.12 standard include Elsevier, Kluwer, Wiley[33]. The operations phase of the company involves the creation of databases from material – bibliographic and contents pages – provided by publishers; this drives access to current document delivery services offered by the company through Faxon Express. The company have entered into various value-added partnerships – with OCLC, and with the Adonis project; they are also negotiating with CD-ROM vendors. The company will act as a customizer, adding value that suppliers (publishers) may not have time to generate,though Richard Rowe, the company CEO, anticipates that 'Some publishers will want us to be the actual distributor of their material electronically'[34]. At the output end of the value chain, EDI plays a role in linking with the library communities who are Faxon's customers: because of a lag in the pace of integration in library automation, the full benefits of such links have yet to be realized.

Faxon's position as a purveyor of full-electronic text (as distinct from text sent by fax) is constrained by current contracts with publishers, which require the destruction of electronically stored documents after three days – but the company has a strong client base (in its existing library customers), and a move into document delivery should not be difficult to achieve if and when the circumstances are right.

What points in common does Faxon have with the other clients described here? Like Geac it offers conformance with major technical standards; like OCLC, strong client base in the area of document supply; when the client's technology allows, the move to full electronic delivery should not be difficult to make.

RLG's Ariel and Citadel

The Research Libraries Group, (RLG), conceived in 1973, was originally an elite club of Harvard, Yale, and Columbia Universities, and New York Public Library. One of the primary purposes of the group was to find cooperative solutions to 'the financial squeeze that afflicts... most of the city's major non-profit cultural institutions'[35], through coordinated purchasing decisions, shared materials and the use of computer technology. The group quickly expanded, and picked up funding from foundations and research organizations to embark on cooperative endeavours with and for members, and devise strategies; the group's membership in 1992 was more than 1210 libraries (including the British Library), though its total membership at any time has never been more than a fraction of all college and research libraries.

The group's primary product is the Research Libraries Information Network (RLIN), an online union catalogue of some 50 million items held by member institutions and archival repositories. RLIN members use it for technical processing, and its searching service is open to non-members as well. Two recent services are more directly relevant to document supply – Ariel, a high-quality transmission system for document images, and CitaDel, a fixed-fee online-searchable article citation database and document delivery service. The purposes of RLG, as stated in its certificate of incorporation, are carefully worded to ensure that the group and its members meet all restrictions under Section 501(c)(3) of the Internal Revenue Code: cooperation is stressed, as is resource sharing, improved searching and access, and greater efficiency[35]. A more recent statement shows some shift in focus including as an objective 'To develop the component parts of a seamless information delivery service capable of putting catalogue, index, abstract, full-text, and image information directly into the hands of scholars and students'. Recent promotional material stresses a steadily rising demand for 'greater access to the array of interdisciplinary information resources needed in modern scholarship...' and emphasizes the role of 'technological change' – software that 'can operate on a range of platforms... standards for hardware, software, communications protocols and data description'[36]. RLG considers that Ariel is rapidly becoming an international document-delivery standard, with state-of-the-art image transmission software, that 'provides rapid, error-free, electronic delivery of any black-and-white or grey-scale document over the Internet', and 'outfaxes the fax'.

In 1991, RLG reshaped its governance, membership structure and services to make the organization more flexible, and enable it to undertake new initiatives[37]. The organization has an enormous resource base in its member holdings, and its member task forces and committees are continually creating or locating additional databases of material to add to the collections. RLG also uses input from other suppliers: for the creation of CitaDel, it negotiated a beginning set of

Exhibit 7

	DOW JONES	OCLC	RLG	FAXON
VALUE ADDED PARTNERSHIPS	America Real-time Services Desktop Data Scan Verity Inc Gescan Reach Int. Inc. Business Wire P.R. Newswire Canada Newswire	Faxon ISI (RLG) Feeder Libraries Bellcore AAS	UMI (OCLC) Ei Article Express	Faxon Publisher's Adonis OCLC (CD-ROM Vendors)
STANDARDS	X.25	STANDARDS BODIES	STANDARDS BODIES X.25 Z39.50 Unicode	STANDARDS BODIES X.12

files from UMI; much of the value-added activity of the group is carried out by task forces and committees, and the organization holds memberships in many other professional and scholarly organizations; it also has cooperative projects with Canada, the UK, France, Italy and Spain.

In recent years, RLG has become much more competitive[38]. In 1988, RLIN prices were restructured from charge by data processing transaction to charge by data access (searches), and in 1992, CitaDel undercut most competitors with fixed pricing for a year's search contract, based on the number of simultaneous users: this was imitated in a few months by other contenders: OCLC changed its FirstSearch fee to flat-fee in January 1993, to be followed by Dialog and Wilsearch. CitaDel also competes on delivery costs – $7.75 for articles of any length from the UMI files, for example, with delivery by first-class mail or Internet (via Ariel). This may be compared with CARL, whose rates vary with length and royalty to the publisher, but average $12-$15 per document. (Both accept payment by individual credit card as well as institutional accounts).

The competitive position of RLG is not clear-cut. Though the organization competes, as we have seen, on price and coverage, it has in the past, and is currently involved in alliances with what appear to be major threats. RLG and OCLC, for example, exist in a state of fluctuating symbiosis[39] – the former may be seen as targeting a smaller number of large prestigious and influential members, institutions; the latter is aimed at the great mass of middle libraries (over 10,000 of them); and there is some cross over in membership. An attempt to form an inter-system link in 1992 failed. CARL is another potential competitor, with a TOC which is broader in scope, but which offers only limited coverage form 1988 to the present[40]. UMI, a major supplier to RLG, may find sales from its database directly to consumers a very attractive concept, and is moving into supply of full-text images via CD-ROM, and a new entrant, Article Express International (a joint venture between Dialog and Engineering Information Inc) is a combined vendor/database provider which could undercut any single venture. Article Express, will, however, provide document services on behalf of its two parent companies, and for RLG's CitaDel, at prices higher than direct order for CitaDel, but offering access to a combined resource set that is large in scope[41].

While RLG's most important buyers are its member institutions, these members are increasingly making economic decisions from a widening range of choices, and RLG will have to compete for member loyalty and appeal to non-members; individual scholars, for example, may be a small market at present, but their purchasing power and technical capability are likely to increase. The Internet itself is a potential new entrant into the area of document supply: the Internet Gopher greatly enhances the access power of the individual at subsidized rates, though high volume transactions may cause problems[42].

Some conclusions

What conclusions can be drawn from this brief review of the operations of five potential players in the area of document supply? Firstly, that any conclusions will be based on imperfect information: the authors, experienced searchers, have trawled for material on the standard databases, and have made some contacts inside their target organizations, but all are aware that their narratives are partial. There are clearly limits to what an outsider can learn. This need not devalue the study, however, as the sources which lie behind it are similar to those which a working librarian could access as input into a decision-making process relating to document supply. The profiles of company operations in this study do confirm Malone's observations on markets and value-added partnerships: there is a clear need for agents who can both inform and deliver, and companies like OCLC are adopting both roles. The breakdown of vertically integrated supplier-buyer exchange (the publisher/supplier – library relationship) means the break-down of assumptions about who library professionals should deal with – the range of alliances (or value-added partnerships: these are illustrated in Exhibit 7) may well influence a decision to play with a particular partner (as much as coverage and cost alone). A partnership like Dynix-Ameritech, for example, extends the range of potential document suppliers and blurs the traditional boundaries of content and carrier. The detected shift to supplying the individual researcher (in academic or corporate environments) has opened up opportunities for customized service which are clearly recognized by all of the players reviewed (with the exception of Geac), but such supply may result in the erosion of the historic institutional base of Faxon, OCLC and RLG.

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The poor man's Internet: reaching the networks with e-mail only

Michel Bauwens
BP Nutrition 92, Desguinlei, 2018 Antwerpen, Belgium.

Introduction

'If you're not on the net, you're not in the know', stated *The Economist* in its 1992 year-end review of conspiracies and networks. While it is true that the Internet is a wonderful resource, i.e. an ocean of information waiting to be tapped, and while it is also true that the information is freely available, not everybody has access to it. If you're working for the academic community or some research institution, you probably only need to ask your local system administrator.

However, as a corporate librarian, working in mainland Europe, I have struggled for months to obtain access. No Belgian university was willing to open an Internet account for a 'commercial outfit', even though I would not have used it for commercial purposes. However, a relative breakthrough came the day when Data Star's electronic mail service, i.e. Data Mail, connected itself with the Internet. From that day onwards I obtained limited access to the Internet. It was limited in the sense that it does not offer full interactive access with the Internet.

The Internet normally allows for three kinds of interaction. The first is electronic mail, i.e. the ability to send and receive electronic messages, with all e-mail systems connected to the Internet. The second is the ability to search remote Online Public Access Catalogs of libraries with the telnet command. The third is the ability to retrieve files (text, data, and software) from public servers with the ftp command. Data Mail only allows for the first kind of interaction. It is my purpose to show that despite these shortcomings, e-mail connectivity already opens up tremendous opportunities for interacting with colleagues, finding information, and Continuous Professional Development.

For the novice user, I will first introduce some concepts.

The world of electronic networks

The world of electronic networks consists of three main technologies. The first is electronic mail – in simple words the ability to send and receive electronic messages. It has several advantages when compared to postal delivery and the telephone: delivery is faster than postal delivery, (sometimes almost instantaneous) and unlike the telephone, the recipient does not have to be present. In other words, the constraints of time and space are overcome in this asynchronous communication medium. E-mail is particularly effective for one-to-many correspondence. A time-saver is the fact that electronic documents can be exchanged, and edited without retyping. Currently available e-mail systems allow for direct contact with the fax, telex, and postal system worldwide. In other words, even if your correspondent has no access to e-mail, your message will be sent through the medium of your choice. In other words, almost anything can be done from your desktop. With a portable, modem and the right passwords, or if your organization has 'hot-desking' capabilities, you become independent of time and place. You can work anytime, anywhere, and can reach everyone, everywhere. Other advantages are that e-mail 'hides' gender and race identity, and can cut across hierarchy. All ideas here have equal value if they are well presented. This 'advantage' cuts both ways of course: private Bulletin Board Systems (BBS) are notorious for the fact that many invent 'fake' personalities (their 'modem persona' differs from their 'meat persona').

The second technology are the Bulletin Boards. A BBS creates the possibility to engage in public discussion and creates an interactive community. A BBS makes many-to-many communication possible. You leave a message for all to read and anybody can attach his comments. This creates threads of topic-oriented discussions which are a learning experience to all. It is also an ideal medium for asking and giving help. Ask a question and all those with something to offer can react instantaneously with their advice. The third technology, i.e. conferencing systems are a further outgrowth of Bulletin Board Systems with more capability. Topics can be branched and subdivided, several phone lines can operate at the same time, etc... Advanced systems allow for real time discussion. It is an attractive medium to conduct electronic meetings on topics with a certain urgency.

These technologies could historically be accessed through three kind of networks. Using the terminology of network pioneer John Quarterman (author of *The Matrix*)[1], we can distinguish three camps[2]: The first Camp consisting of the research and academic networks, the second consisting of commercial conferencing systems such as CompuServe and Delphi. The third camp consisted of many independent, mostly local, Bulletin Board systems. Historically these three camps were at 'war', but today they are interlinked to different degrees through the Internet. Thus, the

Internet can best be described as the 'network of networks', a sort of backbone network connecting the different systems to each other. As Quarterman says, 'trade routes' have now been established, allowing anyone to contact academic resources (Camp 1), consumer oriented services (Camp 2) and the computer underground (Camp 3). However, as the Internet is an initiative from the well-funded academic networks, they have full access, while others mostly have merely e-mail gateways. Commercial companies in the US and the UK are now providing full interactive access to anyone who opens an Internet account. We'll mention the latter possibilities later.

How to access the Internet

The first step is to open an account, for example, through DataMail. Once you open an account, the next step is to collate addresses. Indeed, for the moment there is no overall directory of e-mail addresses. Some limited directories exist but they are not so easy to use for the novice. So our recommendation is to start experimenting by sending messages to the people that you know, or that you get to know through interpersonal networking. Try to be familiar with the simple procedures of your personal e-mail package: sending messages, reading and scanning incoming mail, downloading and uploading items (the latter depends on your communications software), forwarding, etc... Through the Internet you will be able to contact millions of addressees on the Internet proper (various academic and research networks), on Bitnet (a specific network linking IBM-machines at research institutions in the eastern USA), on commercial systems like CompuServe and MCIMail, and on Third Camp systems like PeaceNet and FidoNet.

While Internet addresses look difficult, they are, in fact, no more complicated than a postal address. A typical address will look like this:

Michel.Bauwens@dm.rs.ch

The first part is the recipient's name, 'as known to the computer', i.e. it can be a nickname or a string of numbers too! The second part, separated from the first through the ascroll sign (@), is the name and the location of the computer, with several parts separated by dots. In our example 'ch' denotes the domain, i.e. the network itself (remember the Internet is a network of networks), 'rs' denotes a sub-domain, while 'dm' is the name of the host computer itself. After a while, you will notice that outside the US, the last two digits denote the country (in this case: Switzerland), while within the US the last three letters give an indication as to the nature of the owners of the network (i.e. 'edu' for education, 'com' for commercial, mil, gov, etc...). Bitnet (a historically separate network, that is now linked to the Internet as well) users usually only have one string of letters after the ascroll. For example @BYUVM. If you're not on Bitnet yourself, simply add '.bitnet'. Our example then becomes @BYUVM.BITNET.

Using listservs

When you feel confident enough, it is time for the next big jump: using or subscribing to listservs[3]. Listservs are basically mailing lists, but they function a little bit as Bulletin Boards. The basic difference is the following: a BBS creates a 'public' space for all to see. Thus you have to 'go to' that space yourself. A listserv is merely a software program that ensures that any message routed to the mailing list, will be sent to every single subscriber of that list. It is an ideal tool for experts to get together and send each other news, post queries, discuss controversies, etc... They could be considered back-up systems for difficult queries (if your database search did not provide the right answer), and on the other hand they are a tool for professional development. Use them to be informed about the 'issues of the day', to discuss drafts of upcoming articles, etc... Remember: with a telephone you can only reach one person at a time, with a list you can connect to several persons, some of whom you may never have thought of, yet they may have the answer to your query. Even if they do not provide you with a full answer, you will get invaluable tips. The problem with listservs is to find the appropriate one that fits your interest. Tools and resources for identifying them will be discussed later. A listserv is a flexible tool: you can subscribe for a short time only, or simply send one query and ask that replies be sent to your personal mailbox. It is considered common courtesy that you then send a summary of these responses to the list, so that others may benefit from that information as well.

Subscribing to a listserv is fairly easy. It usually requires that you send a single sentence in the body of the text, leaving the subject line blank. For example, if you want to subscribe to the Help-Net discussion group, you will be asked to send the message 'Subscribe Help-Net Firstname Lastname'. Be careful, while contributions should be sent to the address of a list (for example 'Arachnet@acadvm1.uottawa.ca'), your subscription request should be sent to the listserv software program (i.e. 'listserv@acadvm1.uottawa.ca'). Trying to subscribe by sending a message to the list instead of the listserver is a mistake which is very annoying to existing subscribers, and it will fail as well. When you subscribe, you will get an introductory message explaining how to obtain files, search the archives. These procedures are not difficult. For instance you can obtain any file by sending the 'get filename filetype' message in the body of the text.

Subscribing to such discussion lists poses a time management problem though. Expect to get from 10 to 40 messages a day! A lot of the messages are of doubtful value and can be considered 'noise'. The problem is even more acute if you subscribe to Usenet[4] newsgroups: in that case traffic may increase to up to 400 messages a day.

So you have to be choosy, but choice can only come from experience and from trying things out. To avoid the problem of 'noise', some discussion groups are moderated. In this case a human moderator screens messages before posting them. Another alternative is to choose the Digest option. Instead of getting messages separately, you will get them all together once a week. Your willingness to participate will vary: the first stage is usually called 'lurking', i.e. you are then a 'wallflower' who merely 'listens' (reads), without participating directly. It is a proper way to behave in the beginning in the passive learning phase. Next you may want to become an active participant in an existing discussion or even initiate a new topic yourself. Responding to queries, or posting information about a good resource, is usually appreciated. Usually I say, as this very much depends on the specific policy guidelines governing the discussion group. To give you an example of how difficult it is sometimes to judge what is proper: a student was recently criticized on one list for posting a query that 'he could have found in his public library', while others congratulated him for 'making use of the electronic resources as a new source of information'. Discussions sometimes degenerate. A participant posts an item not considered proper by other participants and a discussion follows. Then some participant objects to the discussion 'about the discussion' setting off a chain reaction in which 'everyone wants to have his say'. It requires a skilful moderator to smooth things down again.

Participating in listserv discussion groups require that you know something of 'netiquette'[5], the rules of 'proper behaviour' in cyberspace. These rules are common sense and amount to simple courtesy. For example, it is suggested that you avoid CAPITALS as this may denote that you're angry. Avoid 'flaming', i.e. angry outbursts. You may want to use 'emoticons' such as 'smiley' :-). Indeed remember that electronic communication has drawbacks: it lacks the visual and auditive emotional clues and body language. Without this full texture of real human interaction, irony and humor may easily be misunderstood. Flaming is a consequence of this: some people seem encouraged to rude language and insults because you are not 'really' there to confront them. E-mail also encourages 'quick' and informal responses because it is such an easy medium. A good idea is to wait before sending responses to items with which you disagree: it avoids the public embarrassment of having said things that you will later regret.

Another problem is the quality of the information. As an 'anarchic' medium, the Internet does not only carry low quality dialogue of the graffiti board style, but also plain wrong information, rumours, incorrect citations. There is no stringent quality control on these listservs. Everything therefore rests more or less on the reputation of the respective participants: just as in real life you will learn whom to trust and whom not to. The future will bring new problems: the first one is encryption. Encryption[6] technology has now reached the stage whereby some codes cannot be cracked at all. While this increases privacy (a good thing), think of how criminals and terrorists could use the Net, undetected by anyone. An interesting anecdote is that the Iraqi Army used commercial Internet channels to communicate during the Gulf War, and thus their communications capabilities survived much longer than expected.

Next comes multimedia technology: it is impossible to judge the authenticity of digitized media. Will we see the day where anything electronic will not be acceptable proof in court?

Let us now turn to a third way of getting the most out of Internet resources: subscribing to electronic journals.

Electronic journals and newsletters

These journals[7] exist in different formats. One alternative is the simple electronic version of an existing print journal, with the difference that the e-version is usually in ASCII (full 'graphical' e-journals exist, but they presuppose that you have the right software to read them). Other journals have chosen new formats. Indeed why not adapt yourself to the new medium, instead of simple duplicating the print alternative. So some journals will send you the articles irregularly, as soon as the authors have written them instead of sending the journal in full 'issues'. Others will alert you with a Table of Contents, and explain how you can obtain the individual articles, again by sending simple messages. Expect that the future will bring an increasing variety of titles, when the mainstream publishers[8] will discover that the Internet consists of a huge audience of professionals. Table of Contents databases such as Uncover from CARL, Faxon Finder, and FirstSearch from OCLC's EPIC[9], are also portents of future developments when the fulltext and full-image version of journals will be available for the asking. An interesting phenomenon is 'electronic skywriting'[10] : these peer-reviewed electronic journals (such as Psycholoqui) try to create a new way of communicating based on the advantages of the electronic networks. The idea is to post an idea or finding, to which your peers must respond very quickly. According to the initiators such skywriting (i.e. 'writing as in the sky for all your peers to see it'), reduces the time lag between the original thought process and the written dialogue about them. Instead of waiting years before a finding is integrated in new research this process could possibly reduce that time lag to a period of weeks and months, thus greatly quickening the process of innovation. Such peer review may be an appropriate response to the low quality dialogue on the regular listservs. Here a selection takes place as to the participants to ensure quality. A somewhat different attempt is the Virtual University initiative, but here instead of peers in a particular discipline, the aim is to get interdisciplinary teams to work together electronically on certain research projects.

Now: how to access all these goodies? Again the matter is rather simple, even for the 'poor man' with only e-mail access. For example, if you want a subscription to the Electronic Journal of Virtual Culture, simply send the message <Sub EJVC-L Firstname Lastname> to listserv@kentvm.kent.edu. That's it. Next, you will get the journal free in your mailbox for as long as you care to receive it. Several directories are available to identify those resources suited to your needs.

What's in it for the corporate librarian: a short case study

As Information Officer for a multinational company active in agribusiness I have a particular interest in information sources about the CEE/CIS region. A first way of finding such information on the Internet is through appropriate newsletters. The Letter is a weekly eight-page electronic business newsletter, which covers the CIS Republics. Another company, i.e. A & G Information Services distributes electronic bulletins providing information about Russia and St.Petersburg divided into eight sections (privatization, tax, etc...). The bulletins are issued once or twice a week (each 3-5 Kb weekly). For example, their Business Review abstracts articles on topics of Russian business life (6-10 kilobytes weekly).

Listservs are also of interest: E-EUROPE on Listserv@Pucc.Princeton.Edu (The Eastern European Business Network) is the electronic communications network for studying the CEE/CIS business and economic systems. It links academics, students, researchers and business practitioners in Western Europe-Asia-North America with those in the CEE/CIS. Miscellaneous datafiles which are of interest to the business information researcher, are available for downloading by sending the 'GET E-EUROPE FILELIST' message to the listserv address. For example File10 contains the 'Eastern-European List of Electronic Resources, compiled by Zbigniew J. Pasek of the University of Michigan. Obtain the file by sending the message 'GET E-EUROPE FILE10' to <Listserv@pucc.princeton.edu>. To be informed about updates to this list, send the message 'AFD ADD E-EUROPE FILE10' to the same listserv. To subscribe, send the message, 'SUB E-EUROPE yourfirstname yourlastname'. This list allows you to subscribe to country-specific news services (all free), carrying highly valuable market reports from US embassies. Many other discussion groups are of interest: Hungary@ucsbvm.bitnet; BALT-L; GAZETA (Review of daily news from Poland, distributed through Fidonet); MIDEUR-L; RFE/RL DAILY REPORT (Radio Free Europe/Radio Liberty daily news report); UKRAINE; CROATIAN NEWS, etc... There are many, many more. The electronic resource list 'Not for Cows' shows you how to subscribe to more than 60 electronic discussion groups and listservs of interest to agri-business researchers! There is also a growing number of local BBS, which can be accessed from abroad. Most are connected to the West through FIDONET.

The point here was not to be exhaustive or to offer you a guide, but simply to show you that the Internet is also there to be used by corporate librarians! Remember also that the Internet is now opening itself to commercial entities, which will be able, through the appropriate channels, to sell valuable information.

More advanced uses of the internet

When you are comfortable enough to use e-mail and listservs, you may want to try your hand at some of the more advanced features. We have mentioned FTP before, i.e. the File Transfer Protocol that allows you to move a file from a distant public server to your own PC. To do this you would normally need full interactive access to the Internet. However, there is an alternative e-mail method, i.e. using FTP-mail gateways. These are servers that work as intermediaries: they convert your e-mail messages to ftp commands, retrieve the files, and send them to your mailbox. For details, send the message 'Help' to ftpmail@decwrl.dec.com.

Finding a specific piece of information is not easy. Retrieval works on the basis of association and referrals. Listservs, for example, often post items referring to new information sources. Querying an expert or posting a question to a discussion group is a little more focused, but still not good enough. It is therefore quite logical that now that the Internet has evolved from the phase of the pioneers to the phase of the settlers, that efforts are being made to build retrieval engines so that the Internet may become more manageable. Thus you will hear about Archie, Gopher, WAIS, and the World Wide Web. These retrieval systems require a remote login with the telnet command, but Archie can be reached through e-mail! Archie is a system which allows the searching of the file indexes of the public servers, by filename or keyword. As with ftpmail the procedure is somewhat complex so for further instructions, please send the message 'help' to an Archie site (f.e. archie@archie.rutgers.edu). Archie also offers Directory services which may help you to find e-mail addresses[11].

At this stage of your exploration of the Internet as a 'poor man' using e-mail only, you might be ready for the 'big works', i.e. full interactive access[12]. This is a story already well told by many others, so I will not repeat it here[13]. Suffice to say that despite my own negative experiences in Belgium, it has now become easier to have such access through commercial providers who have stepped into that vacuum. In the UK you are particularly fortunate to have Demon Systems, a company specializing in offering Internet access to commercial accounts for as little as £10 a month. Delphi, a worldwide commercial provider of electronic mail and computer conferencing also offers full access.

Information management issues

Let us mention some information management issues before concluding. The first problem is information overload. Even if you're not an addicted 'information junkie', monitoring listservs could be a professional requirement. Letting all librarians monitor the same listservs would obviously be a waste of time, so organizational issues are involved. If and when the volume of incoming data becomes too important, you might want to investigate information filters[14]. Using a combination of direct feed technology and text management software, they will filter your incoming mail, match it with preset interest profiles, and route it to the appropriate recipient. Products currently on the market are Logicon and Grapevine, but traditional real-time filtering systems such as Topic should also be investigated. The University of Berkeley is also experimenting with a listserv filter. A related development are the knowbots, or knowledge robots[15]. These are 'automated reference librarians' or software 'worms' that can go from source to source looking for answers. They are able to travel the networks autonomously and come back to you when the work is done. Knowbot Information Services is a first application of that principle: it is designed to contact directories looking for specific people. Another knowbot experiment seems to be ZONE (Zealot of Name Identification, developed at SRI International), which automatically probed its way down to the remote reaches of the Internet looking for hosts. After 7 days, it had located 535,000 hosts in 16,000 domains (a host can consist of thousands of users).

The Internet will undoubtedly affect our jobs and working practices. No longer will it suffice to know how to use printed sources and databases. Knowing how to navigate the Internet will become a basic requirement for the information professional. Keeping a pulse on the Net is especially crucial if we want to keep track of innovation. Remember how researchers are now holding preliminary discussions and posting draft articles on the Internet, long before the printed version will appear ... if it does! The Internet is also a crucial tool for interpersonal networking. Computer-assisted cooperative work will become increasingly common and it will be the Internet who will carry that traffic. With the increasing availability and over-abundance of electronic information, the very nature of our jobs will change. From being 'retrievers', we will perhaps become 'traffic cops', protecting our managers from overload. We will be judged not by the amount of information we provide, but by the amount of their time that we have saved, and by how much faster a project has been completed with our intervention. Perhaps the Internet will also make sure that information professionals will be very much needed in the future: indeed, despite the ever friendlier interfaces and powerful retrieval engines, cyberspace territory is increasing at an ever faster pace, so that it is likely that human guides will always be required. Indeed, unlike physical space-time, cyberspace is by definition unlimited. Our attempts to tame the territory will always be outstripped by human creativity and communication.

The Internet also requires training. According to *Network Nation* by Hiltz and Turoff (1977), there seem to be four phases of interaction with the electronic networks. The first phase is a phase of uncertainty: users will make 3 or 4 attempts at the new technology and will not try again if not successful. The second phase is the one of insight, the 'aha' experience during which the novice user suddenly grasps the potential of the network resources and tends to be over-enthusiastic. The third phase is 'routine': the honeymoon is over, but practical work gets done. Finally, in the 'rising expectations' phase, master users tend to invent new tools themselves so that the network can do the things they want.

The Internet has finally made a reality of the much heralded virtual library. We do now really have access to a 'world of information'. It is up to us to organize access to this electronic library for the benefit of our customers. Starting to use the Internet 'with e-mail only', is a first step in learning to master this new resource.

NOTES

1. John S. Quarterman, *The Matrix: Computer Networks and Conferencing Systems Worldwide*, p.746, Digital Press, Bedford, MA, 1990.

   John Quarterman's newsletter *Matrix News*, monitors network developments. Contact the publisher at jsq@tic.com.

2. For more information about the three camps: Camp 1 is described in the above-mentioned Matrix. Camp 2 will be monitored by a new journal *The Internet/NREN Business Journal*, which will discuss the interaction between the Internet and the commercial information providers. The first electronic version expected for June 1, 1993. Contact the publisher, Michael Strangelove at 441495@acadvm1.uottawa.ca. For camp 3, there is a good overview in Katie Hafner, and John Markoff's *Cyberpunk* (Simon & Schuster, New York, 1991). More and more computer underground magazines and cyberpunk e-zines are finding their way to the Internet. Back issues of many such e-zines are available via ftp.eff.org in the /pub/cud/ directory. To obtain a list of such journals, contact Michael Strangelove. The best printed source for following the scene is undoubtedly Mondo 2000.

3. An updated list of library listservs is maintained by Kara Robinson (krobinso@kentvm.kent.edu). A 'List of Lists' is also available from the listserv at ndsuvm1.bitnet as an 'interest package'. A third list of 'Library-Oriented Computer Conferences and Electronic Serials' is by Charles Bailey, Jr. (LIB3@UHUPVM1). Here is a selected list of library-related discussion groups:

   BUSLIB-L@IDBSU. BITNET, forum for issues related to business Libraries. Subscribe at LISTSERV@IDBSU.IDBSU.EDU;

   COMENIUS@CSEARN.BITNET, an open forum for news on the development of library and information services through computing technology and networking. Subscribe at LISTSERV@CSEARN. BITNET;

   INFO+REF@INDYCMS.BITNET, for anyone involved in the provision of Information and Referral services. Subscribe at LISTSERV@INDYCMS.IUPUI.EDU;

   LIBREF-L@KENTVM. BITNET, an interactive communications medium for reference librarians.

Subscribe at LISTSERV@KENTVM.KENT.EDU;

LIS-LINK@MAILBASE.AC.UK, for news and discussion, open to the entire library and information services community. Subscribe at mailbase@mailbase.ac.uk with the message 'join lis-link Yourfirstname Yourlastname'.

PACS-L@UHUPVM1.BITNET, the Public-Access Computer Systems Forum is one of the more interesting discussion groups. It deals with all computer systems that libraries make available to their patrons, including CD-ROM databases, computer-assisted instruction (CAI and ICAI) programs, expert systems, hypermedia programs, library microcomputer facilities, and local databases. Subscribe at LISTSERV@UHUPVM1. BITNET.

4. Usenet is a Unix-based network that is mainly used to distribute news to a huge audience (2 million, of which many are US students).
5. *Toward an Ethics and Etiquette for Electronic Mail,* by Norman Z. Shapiro and Robert H. Anderson prepared for the National Science Foundation and published by The Rand Corporation, Santa Monica, CA.
6. EFFector Online (editors@eff.org), the newsletter of the Electronic Frontier Foundation, has published a special issue which examined the technical, social, moral, legal and political issues surrounding the uses of encryption in computer based communications. The single essay was entitled *Hiding Data in Plain Sight: Some Key Questions About Cryptography,* by Larry Loen (lwloen@rchland.vnet.ibm.com). It has a detailed bibliography on the subject.
7. Newsletters may be identified through the *Directory of Electronic Journals, Newsletters, and Scholarly Discussion Lists* (2nd ed., edited by Michael Strangelove and Diane Kovacs, Association of Research Libraries: Chicago, March 1992). An updated electronic version is available through e-mail.

   Relevant newsletters for corporate librarians are:

   The PACS Review, an electronic library journal that deals with end-user computer systems in libraries, covering topics such as campus-wide information systems, CD-ROM LANs, document delivery systems, electronic publishing, expert systems, hypermedia and multimedia systems, locally-mounted databases, microcomputer labs, network-based information resources, and online catalogs. Editor is Charles W. Bailey, Jr. (LIB3@ UHUPVM1.UH.EDU). Subscribe at LISTSERV@ UHUPVM1.BITNET with the message 'Subscribe PACS-P First Name Last Name'.

   Subscribers also receive two electronic newsletters: *Current Cites* and *Public-Access Computer Systems News.* Current Cites is a Technology Watch abstracting service monitoring articles on electronic networking technology for the Information Systems Instruction & Support The Library at the University of California, Berkeley. It is edited by David F.W. Robison (drobison@library.berkeley.edu).

   Network News is an online newsletter focusing on library and information resources on the Internet. Subscribe at LISTSERV@VM1.NODAK.EDU. Editor is Dana Noonan (Noonan@msus1.msus.edu).
8. For more information about the forays of electronic publishing on the Internet: 1) *Role of Publishers in the Age of Electronically Published Scholarly Journals: Current Situation and Recommendation,* thesis by Harald Lux (lux@dmrhrz11.hrz.uni-marburg.de).

   John Frank, in *What is an Electronic Journal?,* posted a four-part contribution to PACS-L@UHUPVM1. BITNET (January 21 1993), in which he offers an analysis of various schemes for distributing electronic journals.

   Also of interest is *Forces Shaping the Electronic Publishing Industry of the 1990s,* by Hawkins, Donald T., et al. in the journal *Electronic Networking,* 2(4)(Winter 1992):38-60. They predict that by the end of the decade, 'electronic publishing will be a significant part of consumers' lives,. Refer to the *Internet/NREN Business Journal* (see Note 2), if you want to monitor these developments.

   A useful bibliography can be consulted in *Electronic Publishing on Networks: A Selective Bibliography of Recent Works, Public-Access Computer Systems Review 3,* no. 2 (1992): 13-20.
9. Meckler is planning a new journal, *Document Delivery World,* to monitor developments in that area. For a current overview, see *Document Delivery Over the Internet* by Mary E. Jackson, in Online, Vol.17, No.2, pp.14-21. The December 1992 issue of *Computers in Libraries* is devoted to document delivery issues.
10. The pioneer of 'electronic skywriting' is Stevan Harnad (Harnad@Princeton.edu), who has written extensively on the subject. Refer to his article, *Post-Gutenberg Galaxy: The Fourth Revolution in the Means of Production of Knowledge,* in *The Public-Access Computer Systems Review* 2, no. 1 (1991): 39-53.
11. For more details about Archie and its e-mail interface, refer to *Searching Internet Archive Sites With Archie,* by Curtis Simmonds in *Online* 17 (2), pp.50-55.
12. Commercial Internet Access Providers (full access):
    - Delphi (walthowe@delphi.com)
      tel. 010 1 617 491 3393
    - Demon Systems (demon@co.uk)
      tel. 081 349 0063
    - Pinet (electpub@pinet.aip.org)
      el. 010 1 516 576 2262
    - Portal System (info@portal.com)
      tel. 010 1 408 973 9111

13. General introductory works for getting to know the Internet:

    ED KROL. *The Whole Internet User's Guide & Catalog,* O'Reilly & Associates, Inc., Sebastopol, CA, 13 September 1992. p.376.

    FARLEY, LAINE, ed. *Library Resources on the Internet: Strategies for Selection and Use.* Chicago: American Library Association, 1992.

    TRACY LAQUEY, and JEANNE C. RYER. *The Internet Companion: A Beginner's Guide to Global Networking,* Addison-Wesley, Reading, MA, October 1992. p.208.

14. Chris Plaunt can be reached at chris@bliss.berkeley.edu.

    – Grapevine, tel. 010 1 404 455 8014

    – Logicon (benlogic@digex.com)
    tel. 010 1 703 486 3500

    For background reading on information filters refer to:

    MARSHAK, DAVID S. *Filters: Separating the Wheat from the Chaff.* Patricia Seybold's *Office Computing Report.* 13(11) (November 1990): 1-16.

    Communications of the ACM 35(12) (December 1992):26-81. Special section on Information Filtering.

15. For background reading refer to Demon Knowbots, *PC-Computing* VOL.: v3 n1 p.135(2) January 1990.

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CEC PUBLICATIONS

Aslib, The Association for Information Management, in its role as a National Awareness Partner, distributes the following publications on behalf of the Commission of the European Communities Directorate General for Telecommunications, Information Industries and Innovation (DG XIII)

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Electronic information services in the EFTA countries
– IMO working paper 92/6; December 1992; 10pp

Overview of the eastern bloc on-line information services market
– IMO working paper 92/2; March 1992; 8pp

Overview of the EC videotex market 1990/91
– IMO working paper 92/3; May 1992; 7pp

Structure and development of the European electronic information services industry in 1989/90 *– IMO working paper 92/5; October 1992; 8pp*

Summary results of 1991 executive (information use) panel
– IMO working paper 92/1; January 1992; 10pp

Summary results of 1991 (electronic information services) user panel survey (second wave) *– IMO working paper 92/4; July 1992; 11pp*

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Analysis of components for designing information products

Mutawakilu Adisa Tiamiyu
Africa Regional Centre for Information Science, University of Ibadan, Ibadan, Nigeria

Abstract
Information products are analysed in terms of their linguistic, artistic, technological, pragmatic and contextual components and characteristics, and illustrated with examples of how the components are combined in real-life information products. The conclusion is that the malleability and versatility of the components, and the technological possibilities of combining them provide seemingly unlimited scope for designing and marketing value-added information products in our increasingly competitive and information technology-based societies.

1. Introduction

At one level, information products can be defined as *techno-physical objects* designed by man to express, store, convey and/or transfer communication or information symbols from a particular source to one or more target destinations. Among the techno-physical objects are the traditional information products (books, journals, newspapers and files; maps and drawings; sound and video recordings; paintings and museum artifacts, etc.), as well as the newer electronic products (computer databases and software products, telecommunication-based products, etc.).

At a second level, information products can also be considered to include all discrete *real-time events* designed to express, convey and transfer communication or information symbols. Examples of these types of information products (often also referred to as information services) include a news broadcast over the frequencies, user interaction with an online system, and a presentation by a resource person at a workshop.

In this paper, we shall adopt both of these perspectives of the nature of information products. However, despite this broad view approach, there still remains the nagging philosophical question of whether human beings, in being able to cognitively store and transfer knowledge (higher-order information symbols), could also be regarded as information products. In this connection, we would also like to mention a proposition by Mowshowitz (1992), that an information product could be referred to as an 'information commodity' in a commercial sense only if it can be owned, valued and traded. Thus, an expert system software product would easily qualify as an information commodity. However, in this respect also, there is the question of whether a human expert who owns and could value and trade some of his knowledge and skills could qualify as an information commodity.

The purpose of this paper is to review some conceptual and practical issues pertaining to the design of information products for the information services market place. We shall attempt to analyse information products in terms of the conceptual building blocks for their design, and review how such building blocks are 'assembled' to create, customize, and market specific new information products in our modern information societies. The paper is concluded with a review of the opportunities and drawbacks of the new information technologies for the profitable design and marketing of information products in an increasingly innovative and competitive world.

2. Packaging and customization of information products

A very apt characterization of our evolving information societies that I read in a now forgotten source is that 'Presentation is the Cinderella of the Information Age'. Such a characterization emphasizes the observation that in our evolving information societies, much depends on how information is actually presented, and that there seems to be an ever-increasing scope for innovative techniques for packaging, customizing and presenting information products to prospective consumers or users of information.

The credo of the business of designing, packaging and customizing information products for target consumers or users derives from the following two observations.

- that the 'information value' of an information product to a consumer of the product is probably more a function of the consumer's psychological orientation to the production than it is of the producer's or supplier's intended informational content'. Zurkowski (1984) has observed that individuals tend to develop personalized cognitive screens to help them handle the information explosion in the environment. Additionally, there might also be physical, technological, spatial, temporal and other obstacles or 'screens' that prevent people from knowing about, appreciating, acquiring, using, and deriving maximal value from available information products.
- that advances in technology and the increasing level of societal sophistication in the demand for and use of

information is making it imperative to consider the customization of information products for specific clienteles as a viable and ultimate marketing strategy (Marsden, 1990).

Information product packaging, customization and presentation activities seek to increase the probability that prospective consumers would know about, appreciate, acquire, use and obtain maximal value from information products that would otherwise be inaccessible. In other words, the objective of the business of packaging and customization activity is to penetrate the cognitive, physical, technological, spatial and temporal screens of target consumers who would derive value from the information content of the information product(s).

The use of product packaging and customization techniques is as naturally occurring as human communication itself. Clearly, information packaging techniques are used when an author writes his manuscript, when a reporter files in a news report, when a publisher or editor decides on the layout and format of the contents of a book, magazine or newspaper, when a consultant advises on policy, when a seminar resource person makes his presentation, when an advertiser issues a promotional message on a product, when a customized reporting agency provides a financial analysis of an organization in response to a client's request; and also when a newspaper vendor arranges the tabloids on the newsstand.

Mowshowitz (1992) has presented an analytic model of the value-added layers in the packaging and customization of an information product. He identifies the following five layers: (i) development of the *kernel,* i.e. the sense-making content of the product; (ii) *storage* or encapsulation of the kernel in a techno-physical media or channel; (iii) provision of information *pre-processing* tools, for accessing the kernel as had been technologically-encapsulated; (iv) *distribution* of information products over space by traditional transport or electronic signals systems; and (v) the *presentation* of the information product to the consumer of the information product.

In other words, principles of *value-added* packaging of information products are relevant not just when the finished product is to be presented to the market. They are relevant during the actual creation of the potentially meaningful assemblage of information symbols, through the encapsulation of the symbols in information technology and media, and through to the distribution and 'real-time' presentation of the product to the consumer or user.

3. Components for designing information products

Are there general principles of effective information product design? Orna (1992) has observed that to succeed in designing value-added information products, one needs to know about users and what they do, to understand the nature of the information they need, and to possess skills and understanding in both the conceptual and visual organization of information. Similarly, Yerbury and his associates describe the design task as one of a 'planned solution to an information handling problem' based on knowledge of the user, knowledge of the subject matter and knowledge of how to present the message'. (Yerbury et al., 1991, p.132). They also describe a tutorial activity for systematically making 'visible' to learners the otherwise 'transparent' features of good and bad information design.

But is it possible to identify the building blocks or component factors which could be assembled or interrelated for designing value-added information products?

Our analysis of the problem led to the observation that to effectively package or customize an information product for a *target consumer market,* it might be necessary to modify or change one or more of the following characteristics or components of one or more existing information products[1]:

- primitive communication symbols;
- organization of the symbols into higher-order communication symbols;
- visual and/or aural representation (if applicable) of the symbols;
- media/channel/technology for storing, conveying, transferring and/or accessing the symbols;
- speed/pace at which communication symbols are generated or presented (measured in terms of the frequency of symbols per unit of space or time);
- place and ergonomics of the real time delivery of the information product;
- real time of delivery of the information product.

We now elaborate upon each of these factors in turn.

3.1 Primitive information symbols

These comprise the primitive letters, words, numbers, primitive geometric shapes, diagrams, pictures, colours, sound notes, etc. that could be used to express a message. One must also contend with the different possible variants of such symbols. For example, the various shades of the colour 'red'; various sizes of the geometric shape 'circle'; various sizes and slants of the alphabetical characters, etc.

3.2 Organization of symbols

There is a blurred line here between primitive information symbols and other higher-order information symbols such as words, phrases, clauses, sentences, graphs, charts, pictures, paintings, music, etc. The important idea here is that at a certain point, simple communication symbols have to be combined to generate higher-order and more complex symbols. The scope of the task of 'organization' of symbols is dependent both upon socially-recognized rules and man's creative powers, and is exemplified by such activities as the composition of a manuscript of a science report or fiction story; the design of a company logo or a bar chart; an architectural drawing or the layout of the front page of a newspaper; etc.

3.3 Visual and/or aural representation of symbols

We all know that there are only twenty-six letters in the English alphabet. However, the possibility of presenting such symbols in different *fonts*, pitches, point sizes, and colour provides an almost unlimited range of 'virtual' symbols that can be used to express meaning. For illustration, the fact that the word 'fonts' in the last sentence is italicized probably provides an effect different than would have occurred had we used the regular font used for other words in the sentence. One can also imagine the effect had we been able to represent the word 'colour' in the sentence in flaming red or blue!

An aural analogue of the visual representation of information symbols is aural representation. As with visual symbols, there appears to be no limits to the different ways that communication symbols can be aurally expressed or represented. Compare, for instance, a poem recited by a person with a Scottish accent with another by a person with an Eastern European accent. Same poem, but different aural representations.

3.4 Physical media/channel/technology for storing, conveying, transferring and/or accessing information symbols

As was explained by Mowshowitz (1992) an essential component of the valued-added make-up of an information product is the process of encapsulating information symbols in the channel, media or technology for storing, conveying, transferring and accessing the symbols. Media channels range from human personalities to technological artifacts such as paper, micromedia, audiovisual media, computer media and systems, telecommunications media and systems, and multimedia. One would gain some insight into the possibilities by comparing a personalized lecture presentation, versus a taped-audio, versus a taped video, versus a long-distance broadcast presentation of the same lecture. Clearly, the potential meaning or understanding that is conveyed would vary as the media/channel/technology of the presentation is varied. Indeed, the channel/media/technologies for presenting information symbols could themselves be regarded as information symbols of sorts.

3.5 Frequency, speed or pace of presentation of symbols

These pragmatic design factors are dependent upon the nature of the information symbols to be presented, the media or channel used for communicating the symbols, and the situational context of the target consumers or users for whom the information symbols are directed. For example, the optimal number of information symbols that can be presented on a page of paper or in a fifteen-minutes lecture would depend on the nature of the symbols, the nature of the media or channel, the optimal use of stimulus variation techniques, the cognitive processing capabilities of the target audience, amongst other factors. Thus children's books are often published in large type-faces, whereas professional journals are often published in 'standard' eleven-point type-faces. Similarly, a lecture presented in a monotone is unlikely to make the same impact on a particular audience as one presented in an optimally-timed sequence of tones.

3.6 Place and ergonomics of delivery of the information product

This refers to both the place, and physical environmental setting for the 'real-time' presentation or delivery of an information product to the target consumer(s) of the product. Place factors are dependent on the technology and economics of transferring products over space. On the other hand, ergonomic factors are interwoven with those of the media, channel or technology adopted for storing, conveying and accessing the information symbols.

3.7 Timing of the presentation/delivery

Secondly, the concept of timing is also relevant to the real-time delivery of an information product (comprising a kernel that had been technologically-encapsulated into a techno-physical object) to the consumer. For example, news, it is said, is one of the most perishable commodities around, whose value depends on the timing of its delivery. Thus, newspapers and news broadcasts are very perishable information products. It is reasonable to postulate that any particular information product attains is highest value at one particular point in time, space and/or context. The task of the designer, thus, is to ascertain ex-ante that particular time, space and/or context, and customize his information product accordingly.

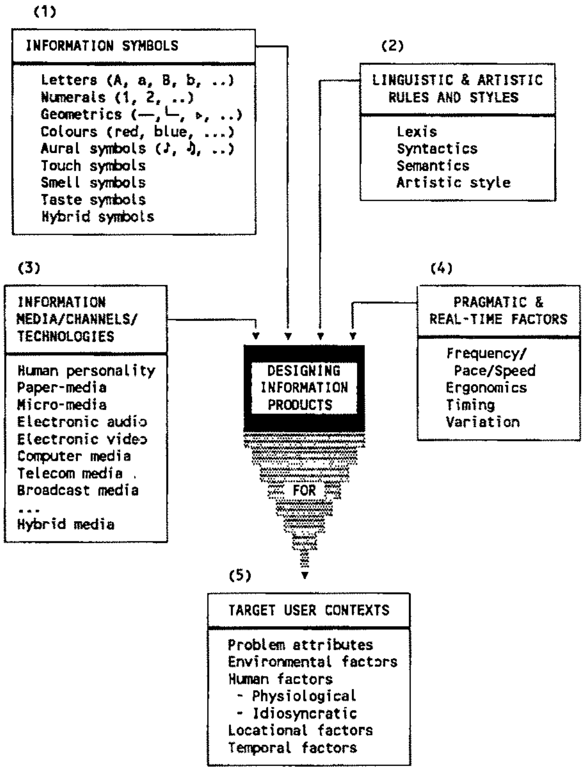
The potential contribution of these characteristics or components factors as building blocks for the design of information products is graphically illustrated in Figure 1. For analytical simplicity, we have grouped the components into five categories, as follows:

1. Primitive information symbols;
2. Linguistic and artistic rules and styles for selecting, representing, combining and organizing the symbols into additional and/or higher-order information symbols, such as a sentence or a painting;
3. Media/channel/technology for storing, conveying, transferring and accessing the information symbols;
4. Pragmatic, ergonomic and real time factors to be considered in presenting information symbols through specific media, channels or technologies to targets users or consumers; and
5. Target context(s) factors which define the characteristics of the target consumers for which the information product is intended/most appropriate.

The figure should be understood as follows. To design information products for target users or consumers (5), linguistic and artistic rules and styles (2) must be applied to organize and expand primitive information symbols into higher-order symbols or ideas. The symbols or ideas must be encapsulated into some media/channel/technology (3), taking into account various pragmatic and real-time factors (4). Actually, to design a product, elements of the five groups of factors must be simultaneously considered and interrelated as appropriate. In other words, the designer of an information product must strive for a perfect fit between information symbols, information medium/channel/technology, and the target context factors, by effectively using linguistic and artistic rules and styles, and by paying due consideration to the pragmatic and real-time factors.

We shall now further comment briefly on each of the five categories of factors represented in the figure.

Figure 1.
Building blocks for designing information products



1) Information symbols

The reader would observe that we have included under this category, visual, aural, touch, smell, taste and hybrid symbols. Visual, aural and touch (Braille) information symbols are presently used in human societies for creating information products, and it may not be too long before smell- and taste-based information symbols are used by themselves or in combination with other symbols to design other innovative products. What about using the expression 'multi-symbol information products' to describe such real-life and futuristic information products?

2) Linguistic and artistic rules and styles

Linguistic and artistic rules and styles are symbiotically-related. Although rules of language exist in natural and artificial language systems, there are usually variants of the rules. Moreover, over time, innovative artistic styles of communication often gradually become accepted communication rules, thereby displacing other rules or further expanding the scope of variation in existing rules. Thus, art provides human societies with the opportunities for innovative variation in how primitive and lower-order information symbols are organized for communication purposes.

3) Information media/channel/technology

Included in this category are human personality, paper-media, micro-media, electronic audio, electronic video, computer media and systems, telecommunications media and systems and broadcast media and systems. There are also different and ever-growing varieties of each of the above media, channels and technologies. For example, within the paper media set are books (bound or paper-backs), loose-leafs, pamphlets, etc. All sorts of combinations of the different media are also presently feasible. For example, a lecture by a human expert might be facilitated by the overhead projection of charts from a CD-ROM based manual or encyclopedia. The term multimedia is currently used to describe products based on various combinations of textual, audio and visual symbols, media and technologies. We predict that, given the different possible combinations of information symbols, media/channels and technologies, the need for more specific descriptive labels for various specific types of 'multi-media' products would soon be felt.

The different information media, channels and technologies provide varying scope and constraints for designers of information products. In other words, designers have to contend with a different set of pragmatic and real-time factors for each type of information media, channel or technology. Barbara Gastel (1983) had highlighted the importance of these factors in relation to different media for presenting science information to the public in the following words:

> '"We in television have a special problem," Jules Bergman, science editor of ABC News, has observed. "We don't have a page 74 or 89... our 30-minute news show – 22 minutes after commercials and promos has only one page: the front page". Both in their depth of news (information) coverage and in other respect, the various media differ despite their parallels. Recognizing the potentials and constraints of each can aid scientists (or designers of information products) in presenting science (information) through them.' *Gastel, 1983, p.60.* (Expressions in brackets have been included by this author).

4) Pragmatic and real-time factors

We have already discussed the importance of pragmatic and real-time factors in the design of information products. Pragmatic and real-time factors are usually defined by the interplay of the characteristics of the different symbols, media, channels and technologies, and those of the target user contexts. Pragmatic factors must either be taken into consideration when information symbols are being encapsulated into techno-physical objects, or during the real-time delivery of the symbols to users, thereby becoming 'real-time' factors.

5) Target user contexts

The potential value of an information product to a specific group of users also depends on a number of situational factors pertaining to the problem-solving, environmental, physiological and cognitive situation of the target group of consumers. For instance, three books by Day (1983) and Barnes (1986) respectively provide advice on how to write and publish a scientific paper, how to present science stories to the public, and how to write effectively in the business and professional fields.

The packaging of an information product is usually performed with a specific consumer or user group in view, even though 'accidental' consumer or user groups might also obtain value from the product. At one extreme, an information product could be designed for mass appeal. To be successfully marketed, such a product should contain either only general information and/or contain as many different types of specific information items as would be of interest to different groups of potential consumers. The latter approach is adopted by traditional print media publications and radio and television broadcasting. In the case of newspapers, the inevitable result is voluminous tabloids containing diverse information items. Most of the items would normally not be read or useful to a particular reader at a particular time and place. Clearly, considerations of chance relevance are important in the design and packaging of such products.

On the other hand, information products might be customized specifically for a limited audience. As the target audience becomes smaller, it becomes necessary and easier to tailor the information product to the specific information requirements, preferences and idiosyncrasies of the target audience. In the limit, an information product might be designed for a single client (e.g. the provision of a management advisory service or a consultant's project proposal). As the target audience becomes smaller, it becomes imperative to possess an in-depth knowledge of the problems, attributes, environmental conditions, cognitive, physical and physiological characteristics, etc., of the target audience.

To sum up, the potential 'value' of an information product depends on how well the designer of the product is able to:

- customize the product for a target group of users by optimally integrating the attributes of information symbols, principles and styles for organizing information symbols, characteristics of information media; real-time pragmatic factors and important target contextual factors; and thereby
- remove or overcome situational barriers to user knowledge, and the actual use, of the product as a source of information by a target group of users.

4.4 Conclusion: the boon and bane of the electronic technologies

Computer and communications technologies have proved to be the engine of growth of the information society. These technologies have expanded the range and depth of information handling tasks that can be performed profitably, both within organizations and in the information services market-place. They have been the source of revolutionary changes in the way that information products are being designed, packaged and marketed.

Developments in electronic technologies are making it much easier to modify the format or structure of information symbols, as well as the ease with which higher-order symbols or intellectual ideas could be composed or expressed. Although the ability to reason and generate ideas is intrinsically a human attribute, modern computer technologies are facilitating the process and speed with which such ideas can be communicated and expressed. Using computers, numeric data can be transformed into easily understood graphs and charts, and textual information can be summarized, modified, manipulated or integrated with numeric data, graphs or pictures. In other words, electronic tools are making it easier to create, modify and produce the kernels of information products. A very recent review of some of the range of electronic aids available to authors for composing ideas suitable for publication is presented by Dorner (1993). Indeed, on-going research in artificial intelligence might eventually enable computers to independently reason and act as humans, thereby creating the kernels of information products themselves.

The flexibility, and the capacity for integration, provided by computer and telecommunication systems is a clear boon to the business of creating, packaging and customizing new information products for specific clienteles. Both Jackson (1992) and Marsden (1990) have highlighted some of the specific ways through which information market participants are exploiting the flexibility of new technologies to design, customize and successfully market innovative information products.

However, the flexibility afforded by the emerging technologies is also, ironically, a bane of the information services business. Commercial providers of new information products must be constantly alert to developments in these technologies, not only because they could exploit them to cost-effectively design new information products, but also because competitors could likewise cost-effectively use them to develop new competitive products.

Innovations in information technology have unleashed two powerful forces that respectively favour small and new, and large and well-established providers of information products.

- With the ever-decreasing costs of basic information technologies, it is becoming easier for new and small-scale providers of information products to enter an information product market with niche products for small localized market segments. This is due to the low start-up costs and overheads of some of the technologies for creating and modifying information symbols, for encapsulating the symbols into techno-physical objects, and for customizing the real-time delivery of their products (e.g. desktop publishing or computer training consultancy).

- With the expansion over time of their stocks of electronic-based information products, large and well-established providers of information products are also finding it easier to engage in multi-product marketing strategies through the creation and customization of both fundamentally and superficially different products by using information technology to 'tease out' new products from their electronic information products and stores. This is due to the ease with which they can integrate their older generations of electronic information products.

In the interplay of these technology-driven forces and the flexibility of the human mind to dream up new ideas for viable information products lie the opportunities for innovators, and the Achilles tendon of complacent information service providers.

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Information for enterprise: the Scottish Enterprise Network and the provision of business information

Jane Farmer, Lecturer and Fiona Sanson, Final Year Student
The Robert Gordon University, School of Librarianship and Information Studies, Hilton Place, Aberdeen AB9 1FP

Abstract
Scottish Enterprise was established by the Secretary of State for Scotland on 1 April 1991 by bringing together the functions of the Scottish Development Agency and the Training Agency. Its overall role is to encourage and aid economic development on behalf of the Scottish Office. Part of this role is the provision of business information and advice services to companies in Scotland, particularly smaller companies. This paper aims, firstly, to examine the structure of the Scottish Enterprise network, looking at the roles played by Local Enterprise Companies (LECs) and Local Enterprise Trusts (LETs). It then goes on to look at how Enterprise provides information for businesses in two distinctly different areas of Scotland - Grampian and Ayrshire. The paper concludes with an overview of current and possible future developments, such as One Stop Shops, and their impact on the provision and uptake of business information.

Scottish Enterprise was established by the Secretary of State for Scotland on 1 April 1991 by bringing together the functions of the Scottish Development Agency and the Training Agency. In the north of Scotland a similar merging of the Highlands and Islands Development Board and the Training Agency took place to form Highlands and Islands Enterprise. The role of Scottish Enterprise is to encourage and aid economic development on behalf of the Scottish Office. As part of this role, Scottish Enterprise have recognized the value of providing business information and, in particular, filling the gap in business information provision for smaller companies. These companies lack the resources to maintain their own information services and are often in the process of starting up or developing new products and services, both particularly information-intensive stages in a company's evolution.

On initially deciding to examine the business information services provided by the Enterprise Network, the main stumbling block seemed to be working out how all the pieces in the Enterprise jigsaw fitted together. To what extent did Local Enterprise Trusts (LETs) and Local Enterprise Companies (LECs) work under the same Enterprise banner towards similar, or at least compatible, goals? Where did they fit into the overall structure?

The next task was to examine how Enterprise worked in different parts of the country, in terms of both information provision and dissemination.

Finally, it seemed useful to try to take an overview of the impact Enterprise might make on the provision and uptake of business information.

As there was a distinct lack of literature about the Enterprise Network (apart from promotional literature), a programme of interviews was carried out with staff from the Local Enterprise Company and a representative Local Enterprise Trust in the Ayrshire and Grampian regions of Scotland. These two regions have quite different economic infrastructures and it has been interesting to compare the strategies which are being implemented to most effectively meet local clients needs for business information.

The Structure of Enterprise

At the heart of the Scottish Enterprise Network is Scottish Enterprise National (SEN) which is responsible for providing the contractual management, overall leadership and support for the network of thirteen Local Enterprise Companies. The LECs' role is to stimulate economic development on a regional level (although they do not adhere strictly to regional boundaries). Each Local Enterprise Company is an independent organization which devises a strategy appropriate for its specific area and agrees it with Scottish Enterprise.

At the grassroots of Enterprise are the 45 Local Enterprise Trusts. Their role is to keep in touch with developments and provide services to meet the very specific needs of their local areas (these tend to conform with district boundaries).

LETs specialize in providing advisory and counselling services to small companies. LETs aim to work in cooperation with LECs, district and regional authorities, and private sector companies to provide services relevant to local business and to avoid wasteful duplication of services. In most cases LETs have contracts from their LEC to deliver specific services to small companies and individuals on behalf of the LEC.

Information and Enterprise

In his annual report of 1992 the then Chairman of Scottish Enterprise, Sir David Nickson, stated that 'the Scottish Enterprise Network and Local Enterprise Companies offer an excellent organization with which to unlock Scotland's enormous economic potential'. It might be argued that providing access to business information is one of the most valuable keys Enterprise can provide to help unlock that potential for economic success. In different parts of Scotland, the structure of information provision is being handled in different ways.

Case study: Ayrshire

Ayrshire is part of Scotland's traditional manufacturing heartland. The industrial base consists mainly of smaller businesses, although the centre of the region has a number of larger companies. In recent years the region has been economically depressed, but the situation now looks more optimistic.

Local Enterprise Company: Enterprise Ayrshire

Enterprise Ayrshire is already well established within the business community and aims to be high profile and easily accessible. It seeks to provide information to improve the quality of businesses and increase their overall potential.

Enterprise Ayrshire has a small library designed primarily for staff use, although materials may be used directly to answer external enquiries. Within this collection staff can access reference works, online databases, an internal company database and sector files which have been established to cover important local industries.

The library is staffed full-time although all company employees are trained and encouraged to use library resources independently. A simple, but effective inhouse classification scheme has been implemented to assist information retrieval.

Within Ayrshire such a business information service is an innovation, providing a unique source of information geared to local needs. In addition to its own resources Enterprise Ayrshire works in cooperation with the SEN Business Information Service in Glasgow and has access to a number of other information services, mainly on a subscription basis. Enterprise Ayrshire provides information free of charge. The charging of fees was investigated, but it was felt that this might detract users and that administrative bureaucracy might get in the way of providing a quality service. The aim is to fulfil requests as quickly as possible after they are made.

Records of requests are maintained to enable staff to monitor demand and the types of enquiries being received. Performance statistics are presented as part of a monthly activity report at the company board meeting. Information services are well supported by internal funding as senior management recognize that they have a strategic value for local business.

Local Enterprise Trust: ALERT

Ayr Locality Enterprise Resource Trust (ALERT) operates within the district of Kyle & Carrick. The main centres in the area are Ayr, Prestwick, Troon, Maybole and Girvan. It is one of five LET's in the Ayrshire area.

Formed in 1983, ALERT is a joint venture funded by local public and private sectors. The Trust also earns income from delivering Business Enterprise Training and Business Skills Seminars.

Although much of the information it provides takes the form of counselling or verbal advice, ALERT has an established business and training library which is available to local companies and clients. A general business information updating service is also provided for companies through the FOCUS newsletter.

One member of staff administers the business information resource and deals with enquiries. Requests for information are diverse, covering all economic sectors including retailing, manufacturing, construction and tourism.

ALERT do not see themselves as providing a unique business information service. Nevertheless, their provision is distinctive in that care is taken to filter information and tailor packages to suit client's individual needs. ALERT is the only service in the area which specializes in providing assistance and information to small companies – for example, advising on the drafting of business plans.

Like Enterprise Ayrshire, ALERT provides business information free of charge. The rationale being that clients have sufficient problems when setting up or developing businesses without the added difficulty of finding and paying for information.

As might be predicted, measuring the success of services such as those provided by ALERT is very difficult. However, the Trust feels that its success can be seen from an analysis of enquiries and their results. The chief executive of the Trust stated that during 1991/92 ALERT had handled six hundred enquiries for information and advice. As a result of this activity 76 new projects had been started leading to the creation of a number of jobs.

ALERT and Enterprise Ayrshire work closely together. As the LEC develops programmes to assist companies in the wider area of Ayrshire, ALERT works to secure contracts to deliver these programmes at the local level.

The Enterprise approach towards business information in Ayrshire has been very much an attempt to provide a service which is relevant to individual clients needs and available on their own doorstep. To this end Enterprise Ayrshire is providing financial resources for the development of resource centres in all the Local Enterprise Trusts.

Case study: Grampian

Within Grampian region there is a wide range of businesses of all sizes. In and around the city of Aberdeen there are many thriving oil-related companies, while in the more rural parts of the region there is still an emphasis on the traditional north-east industries of farming and fishing.

Local Enterprise Company: Grampian Enterprise

Grampian Enterprise stresses that the provision of business information is important in enabling all companies to reach their full potential. Information helps new companies to develop and older companies to grow and, as such, contributes towards achieving a degree of economic stability within Grampian.

Grampian Enterprise has established a library for its staff which is very similar to that of Enterprise Ayrshire. It contains specialized materials such as research reports in key sectors like oil and gas. The library also contains full information on the many services which Grampian Enterprise offers to companies to help them ensure that they are 'fit for business'. Much of the local economic information required by GE is obtained directly from Grampian Regional Council.

At present, Grampian Enterprise does provide some types of business information which cannot be obtained elsewhere within the region, but it may also provide information 'repackaged' from other sources – or refer clients to a more appropriate source if this is what best meets their needs. All information is provided free of charge. Grampian Enterprise also operate STEPahead, a 'training and careers options shop' for businesses and individuals.

Grampian Enterprise feel they are in a good position to gauge the information requirements of business because of their close collaboration with clients. They measure their success in terms of the improved turnover of companies who have used the business information service.

In contrast to the situation in Ayrshire, business people in Grampian (or at least in the city of Aberdeen) have had access to a range of business information resources for some time. These include the Aberdeen City Commercial Library, the Chamber of Commerce Library and the libraries of the two universities, amongst others.

Due to the very diversity of resources available, Grampian Enterprise felt that there was a need to set up a single 'signposting' service to direct business users to the most appropriate provider of information in Grampian. The idea was developed and the concept of Grampian Business Information Centre (GBIC) was formed in partnership with Grampian Regional Council, the Chamber of Commerce, the District Council and the Local Enterprise Trust.

GBIC is now in its final stages of development. It will be based in the city of Aberdeen but its services are to be marketed throughout Grampian region.

Local Enterprise Trust: Aberdeen Enterprise Trust

Aberdeen Enterprise Trust (AET) operates exclusively within the city of Aberdeen itself. It is one of four Local Enterprise Trusts within Grampian region. Established in 1984, AET obtains income from private and public sector sponsorship and earned income.

AET has a small collection of information which is used by advisors in the process of assisting clients. However, staff at AET feel that their collection could be better utilized and are in the process of assessing and reorganizing their information so it can be used to optimal effectiveness.

The business information service takes two distinct forms. Firstly, and most commonly provided, is training and business advice given by business advisors in discussion with firms. Secondly, documentary information of different types is sometimes provided. In offering these services, AET feels that it can give something which is unique and very valuable to businesses in the city of Aberdeen. Performance of the service is measured by closely monitoring the progress of those companies who have received advice and information. Once again, all information is provided free of charge.

Aberdeen Enterprise Trust and Grampian Enterprise have established a good working relationship in providing unique, but compatible services in the advancement of common Enterprise goals.

Conclusions

The Scottish Enterprise Network does seem to be filling gaps which previously existed in business information provision – in particular, free information and advice for developing smaller businesses and free startup advice for new businesses. The Enterprise companies and trusts feel that their services are well used and highly regarded and that the value of the services they provide is reflected in the relative success experienced by companies who have sought their advice and information.

What is particularly interesting is the adoption of different strategies for information provision by the two regions looked at in this study. Ayrshire has opted for a grassroots approach, attempting to provide a service 'on the doorstep' for clients. This strategy is based on the assumption that clients want information here and now and are not satisfied with a service which merely acts as a referral point to another information provider. Grampian, on the other hand, has perceived that the multiplicity of information services available in the region is bewildering to business people. They feel enquirers suffer from the 'pillar to post' syndrome where they may have to contact several different information providers before they find the right one. Grampian has opted to develop a Business Information Centre which will act mainly to refer enquirers to the most appropriate source of information. This service may develop along the lines of the 'One Stop Shops' currently under development and much discussed in England [2]. These Shops bring business information and advisory services together under one banner which means there is less confusion in the marketplace and makes finding information much simpler for the small business. On the surface, the difference in strategies between Grampian and Ayrshire may seem odd, but the different economic situations and traditions in business information provision have to be considered.

It has long been acknowledged that businesses have not been using external sources of information to their best advantage. Independent information providers such as public libraries have tried to tackle this problem in different ways, but have often been unable to fulfil their full potential. Public library commercial services have commonly suffered from some problems. Among these is a lack of resources to promote the service, often coupled, paradoxically, with a reluctance to stimulate a volume of use which would result in the service becoming overstretched.

The arrival of Enterprise on the business information scene makes future prospects seem brighter. Firstly, Enterprise appears to have the resources to try out new strategies in information provision. Secondly, as part of its portfolio of services, Enterprise demonstrates that use of information is an important part of business planning and development. Information is therefore likely to gain a higher profile in the eyes of business people from its involvement with Enterprise.

Information provision appears to be a high priority for the Scottish Enterprise Network. By giving it a more marketable profile, perhaps Enterprise can stimulate more companies to make seeking, using and acting upon good information their own priority.

The authors would like to acknowledge the time and patience of staff at Enterprise Ayrshire, ALERT, Grampian Enterprise and Aberdeen Enterprise Trust in assisting with this research.

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STATUS OF LIBRARIANS IN GHANA

VOLUME 45
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SEPTEMBER 1993

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Evaluating a hypertext document

Duncan Langford
Computing Laboratory, The University, Canterbury, Kent CT2 7NF

Abstract
Hypertext documents can and do make large amounts of information readily accessible to ordinary readers, and production of such documents is understandably becoming more widespread. However, good intentions on the part of authors do not automatically result in the production of cost effective and acceptable documents. Evaluation is consequently a key issue – knowledge and use of appropriate evaluative methods helps ensure hypertext documents are correctly designed and presented. The results are increased usage and efficiency, and decreased maintenance costs.
Drawing on practical, academic and commercial experience, this paper addresses some of the ways in which a hypertext document may be effectively evaluated.

Introduction

Increased use of hypertext by computer professionals has tended to follow technical developments, such as the arrival of faster, cheaper computer systems, and a greatly increased availability of cheap mass storage. However, there has also been growing awareness of hypertext's advantages among professionals outside the computer field. A combination of technical advances and wider appreciation may soon lead to an explosion in hypertext use, but it is also possible that unforeseen experiences might sour hypertext's current positive image among potential users.

An earlier paper (Langford and Brown[1]) argued the case for careful and effective design of hypertext documents. Appropriate evaluation can further improve such documents, principally by encouraging more effective design and reducing the potential for user dissatisfaction. (Neilson and Lyngbaek[2]).

Before moving to examine the issue more closely, it would be as well to explain what is meant by 'hypertext'. Although there are many possible definitions, for ease of discussion I describe a 'hyperdocument' as an electronically stored text divided into discrete information nodes, which are linked in a way which is not necessarily linear. Normally, setting aside specialist work, hyperdocuments can be roughly divided into two distinct categories.

The first, and numerically far smaller group, consists of fairly formal creations. Such hyperdocuments are normally designed and created by a programming team, and are typically intended as a way for unsophisticated users to easily access a very large data set. These hypertexts will typically have a long gestation and high budget, while the purchase of necessary computer equipment is likely to be considered as an essential part of the original specification. An example of such carefully planned development is the impressive National Gallery display in London.

A second, and by far the largest, category consists of documents created to meet a perceived immediate need, produced either 'on the fly' or in strictly limited time. Typically, such documents will have been written by a small number of enthusiasts, who combine a variable knowledge of hypertext with experience of the particular computer system on which their creation must be implemented. Such specialized experience may well bias a choice of hypertext application to one that will run on familiar hardware.

Although documents produced by both groups would benefit from the evaluative measures described here, it is likely that the methods described would be of most use to the second group of developers.

Where to Begin

Developmental issues

Before making any moves to evaluate a hypertext – or, indeed, even to create one – it is essential to clarify its intended purpose (Hardman[3]). Dealing with the issue of task identification in detail lies beyond the scope of this paper; nevertheless, as effective evaluation of a hypertext must always reflect intended use, three important points to be considered when proposing development of a hyperdocument are listed below:

1. Identify the purposes of the hyperdocument

Is it appropriate?
Would a different method of meeting this problem be better? Does implementation fit within current policies, or will it need special clearance? Are there already any guidelines or styles in place that should be observed?

Is it practical?
In other words, do both technical and personnel facilities exist for implementation?

Is it achievable inside defined parameters?
A document may be technically feasible, but impossible, or prohibitively expensive, within particular circumstances. Will any special needs or requirements in this case affect implementation?

2. Identify the users of hyperdocument

Who will they be?

Identifying potential users of hyperdocuments may not be easy – but it is essential; their views should shape your work. A document in search of appropriate users may well be an unnecessary document.

What are their needs?

Here, surmise is no replacement for research. It is vital to identify actual user requirements, rather than the easy option – making assumptions, in the hope users may be persuaded later to like them.

Will needs be met by a hyperdocument?

Matching what users require with what a hyperdocument can offer is sometimes neglected until too late in a development cycle. (It is also true that, even if the potential users' needs are met, people may not automatically start to use the new hypertext. A budget for education may be necessary!)

3. Identify parameters

Parameters that will affect design and implementation of a hypertext include:

Design:

How much data must be included?
How many links will need to be established?
Will further data be added later?
To what depth must the document be 'nested'?
How many users will be active? How long will a typical access be?
Will most users be of a similar level of experience?

Implementation:

What budget is available, in money and personnel?
What time scale is envisaged for production, implementation and testing of the document?
What equipment – hardware and software – is available or obtainable?

Consideration of development resources should not of course obscure the need for planning and budgeting appropriate maintenance resources – after all, it is well-known that, in systems development, maintenance costs far exceed development costs.

Constructing a frame for testing

We will assume an objective has been set, and an audience for the hypertext identified. What tests will allow accurate evaluation of the new document?

For ease of discussion, as a typical example of such testing I intend to describe the ways in which a recently created document, written using the UNIX Guide hypertext system (Brown[4]), was evaluated at the University of Kent (UKC). Although this testing was within a university setting, the hypertext which was examined – Xtutor (Strang and Tardival[5]) – was neither

[redacted]

windows, explains how to manipulate them (including moving, resizing and iconizing) and generally assists the user in practising these skills. Xtutor was developed under the ITTI programme, and was created as appropriate instructional material for any potential user of X Windows. Xtutor is therefore a typical hypertext: it was designed and built for a practical purpose, and contains information intended for a general audience.

When designing tests of any hypertext, as was mentioned earlier, it is important to initially establish its intended purpose or purposes, in order to develop an appropriate frame or target for testing. Only if an objective has been defined and understood can it become possible to judge whether it has been achieved.

A simple illustration of this point could be the construction of a hypertext intended to show tourists the location of attractions in a seaside town. Once completed, the system may appear well received by tourists, who enjoy using it. However, an appropriate testing frame, in addition to objectively confirming the popularity of the hyperdocument, would also determine whether its original objective – to direct tourists to specific attractions – was actually being served.

Xtutor frame

In testing Xtutor (Langford[6]), the objectives were to learn whether users actually felt they were learning from their experiences, and to discover exactly how the hypertext was being used. How people felt about this method of instruction was also considered relevant. Additionally, it would be of considerable help in creating future such documents to learn if this hypertext had been constructed in the most appropriate fashion – would a less dense document (i.e. one with fewer levels of internal linking), or one with a simpler method of presentation (for example, smaller paragraph size), function better?

Given such a frame for testing, it clearly would not be sufficient to stand at the door asking 'Was that useful?'

Automated tests

Hypertext is computer software, and in assessing hypertext, lessons may be learned from studies of software testing (Ould[7], Beizer and Boris[8]). In some hypertext systems, for example, it is possible to examine the structural composition of a particular hypertext by automating a part of the analysis process. Although unrefined, determining the composition of a document in this way can help both in forming a knowledge of its structure and, by extension, its

```
        6 World replace-buttons
        15 Glossary-buttons
        26 Local replace-buttons
        15 Regional replace-buttons
        11 Contexts: Bigger
        38 Contexts: Brighter-colour
        1 Enquiries
        3 Ghosts
     Error: Line 4 – button has no replacement
```

Figure 1 – a sample of Guide analysis

An analysis such as this allows the balance of a document to be viewed in a way that is not normally possible; the hypertext in this example, for instance, appears to use many of Guide's Replace buttons, which might not have been as apparent from simple viewing. Errors, too, can be caught by such programmed checking, shown here by the note of a problem in line 4.

Test subjects

Although some tasks may be automated, for full evaluation of a hypertext it is essential that people actually test it.

Who should be used as appropriate test subjects? This is an easy question to answer – the best testers of a hypertext must be typical representatives of those who will eventually use it. Such 'real' users should of course be involved at the design stage, and throughout development, too. It is always tempting to use as subjects people who are convenient – perhaps even those who are working on the system. For valid tests, though, it is essential that subjects are representative users. After all, knowing its design team like your new hypertext is probably a foregone conclusion.

One advantage about testing in a university is that students are usually available, and can make excellent test subjects – but, of course, only in tests relating to areas where students are typical users. In this case we were fortunate, as Xtutor was principally designed as an introduction and tutorial for students.

Although an analysis will become more accurate as increasing numbers of test subjects are given experience of the system, it is clearly not practical to continue testing without any limits on sample size. I would suggest that, if subjects are typical of final users, around twenty test subjects should provide useful data; depending upon the type of hypertext and user, it may well be possible to produce a reasonable analysis with fewer subjects. In any event, preliminary tests are strongly advised; examination of its results can greatly assist in planning final testing.

Available tools

Once test subjects are identified, we move on to consider practical tools and techniques available to assist hypertext authors in measuring the effectiveness of their designs. As this paper is intended as pragmatic, rather than theoretical, I will not examine theory here. I will also not be considering purely academic methods of evaluation – for example, tests involving duplication of the hypertext on paper. Although potentially helpful, such methods are unlikely to be practical in testing a sizeable commercial hypertext implementation.

Five main approaches are appropriate, and may be used either alone or in combination. I intend first to describe them in general terms, before examining each with particular reference to the example hypertext, Xtutor.

The five principal methods of analysis are :

i. direct observation
ii. background monitoring
iii. verbal questioning
iv. formal questionnaires
v. before-and-after tests.

i. direct observation

In common with all other methods of evaluation, observation should be unobtrusive, and should certainly not be obvious to test subjects – it is important that responses are not artificially biased. At one extreme this method may consist of an inconspicuous observer with a notebook; at the other, hidden video cameras recording every detail of a subject's interaction with the hypertext for later frame-by-frame analysis. Such a level of detail is unlikely always to be cost-effective, though. Simple observation does assist in determining how subjects are behaving during use of the system. It may also show whether the five-minute gap in the middle of an evaluation was due to a subject spending time studying the screen, or in answering their telephone.

ii. background monitoring

Computers are very good at recording the interaction of users with mouse and keyboard. Hypertext applications may either – like UNIX Guide – already have a background recording facility, or, like Apple's HyperCard, can easily have one added. The effect of this function when invoked is usually to time, record and store all the actions taken by a test subject during the period of a test. This record allows every subject activity to be studied at leisure, and in detail. Such analysis can be very useful, as subjective written or verbal reports may not accurately reflect a user's actions. Comparison of 'actual' recorded behaviour with 'perceived' actions reported by test subjects can be most helpful.

iii. verbal questioning

Actually asking users of a system direct questions is often tempting. Surely, this must automatically produce a focused and accurate result? It may well do so; but there are serious potential problems. Test subjects may provide the answer they think you want, rather than their actual views. It may well be that they may need time to consider a question, time which is not available if an immediate verbal answer is required. There is also room for misunderstandings, of both the question and the answer, and a real difficulty in phrasing the same question in exactly the same way to different subjects – essential, if answers are to be compared. Despite these reservations, though, there is room for verbal questioning in the analyst's kit, if only because asking a test subject a question directly can be an illuminating experience, cutting through layers of suppositions to the reality. I once asked a subject at the end of a test why they hadn't used the rightmost button of the three on their mouse; it had puzzled me, and while the test was in progress I had evolved a number of elaborate theories. The actual reply – 'I've got a sore finger' – demolished all of them.

iv. formal questionnaires

As well as monitoring and observing users of a hypertext, it may be useful to directly request their written views on a range of points concerning interaction with the system. This approach has the advantage of gathering specific information, which can then be weighted and directly compared. Results allow focused analysis – difficult with less directive involvement.

It is of course possible to quickly put together a list of simple questions to ask test subjects, and such an approach does have value; but by a 'formal' questionnaire, I mean one that has been carefully designed, and almost certainly given a test run, to confirm that it produces responses in the expected form. The advantages of a formal approach principally lie in the increased reliability of the end product, and the ability to minimize bias through careful composition and arrangement of questions. Describing questionnaire design in detail is complex, and perforce lies outside the scope of this paper (see however Sudman[9], and Bradburn[10]). Basic points to be considered by hypertext authors constructing a questionnaire, however, are in many respects similar to those faced when actually building a hyperbase. Not the least important lie in determining exactly why it is to be used, and identifying areas to be targeted.

v. before-and-after tests.

If a hypertext is intended to increase the knowledge or skills of its users, then a useful way of determining whether it does its job would be to in some way record levels of knowledge or skills before use of the hypertext, and measure them again at the end of the experience. Comparison of the two results should then allow at least some inferences to be made concerning functionality of the system.

The concept is deceptively simple to describe, and may indeed be of considerable use in practice; but apart from the obvious inappropriateness of this approach with many hypertexts, there are potential difficulties. Among them is the problem of establishing a preliminary base-line for comparison; the very act of measuring may alert a user to important points, and therefore bias results. In particular, the issue of the time spent using and exploring a hypertext system must greatly influence effects of the system on a user – but monitored tests are normally of fixed duration. There are other, similar disadvantages. I would suggest that this method of evaluation is used only after considerable thought, and in circumstances where the hypertext clearly has a primary educative purpose.

Application to Xtutor testing

I will now go through each of the above points, illustrating them by drawing appropriate comments and observations from testing of the Xtutor application.

i. direct observation

Xtutor testing was in a public area – the UKC Library foyer – and the use of concealed observers or video cameras was not really practical, even had it been thought appropriate. Direct observation of Xtutor testing was carried out, but from a distance, rather than by observers standing behind the test subjects. Although a formal record of each subject's actions throughout each test could have been taken, less structured notes were considered adequate. In addition to silent observation from a distance, though, test subjects were asked at the conclusion of their tests whether they had any general comments. The form of words used in this request was standardized, in an attempt to keep bias to a minimum. Although in this case no blinding insights emerged from direct observation, several spoken comments provided useful examples of user perceptions, and were included in the final report. It is always worth considering whether direct quotations such as these may enrich an analytical report, illustrating directly points which may have also been presented in other ways.

ii. background monitoring

An often overwhelming disadvantage of background recording as a method of evaluation lies in the sheer volume of material which can be generated. Xtutor tests included background recording, and the details in Figure 2 – from which (to save space) thirty-one lines have been deleted – shows a recording of just 45 seconds of Xtutor use.

```
USER NUMBER 1
POINTS VERSION
TRANSCRIPT STARTS AT Fri Jul 24 11:59:35 BST 1992
[7 lines deleted]
1 15 216 1 7 5. #11:59:39
1 11 205 1 5 3. Demonstration of the X Window
System #11:59:40
1 18 212 1 7 EXAMPLE WINDOW run guide -r -PcX
-name "first example window" -N example.menu -g
600x500+400+70 example.points.1 $1 2>/dev/null &
#11:59:41
-3 820 690 20 11943 << Size change (or de-iconizing) >>
#11:59:46
[24 lines deleted]
10 -1 100 0 0 LEAVE this Tutorial #12:00:20
.tR
.rE
TRANSCRIPT ENDS AT Fri Jul 24 12:00:21 BST 1992
TIME SPENT ON THIS DOCUMENT WAS 45 seconds
```

Figure 2 – a sample of Guide background recording

This test was actually a very short transcript indeed; in the actual evaluation most subjects took at least half an hour, and many longer; in consequence the final volume of recorded data was considerable.

The figure shows clearly the degree of detail obtainable from computer based monitoring. In this illustration of a UNIX Guide recording, quoted text, for example, 'The Mouse Menus under twm' , is actually the title of a selected button. The rather complex description and recording of each user action allows an accurate picture to be constructed – not just what was done, and in what order, but how long each step actually took. In UNIX Guide, it is also possible to use this record as input, using it to recreate the test session exactly.

Recordings of this type can play an invaluable part in determining what users have actually been doing; but, in order to find this out, it is often necessary to sift through a very considerable volume of data.

iii. verbal questioning

In the Xtutor tests, direct verbal questions were not asked. This was partly because of the potential problems outlined above, and partly as the other evaluative methods being used were considered adequate. Testers were, however, asked to write down any spontaneous remarks made by test subjects; although unstructured, this can sometimes provide illuminating insights. In this case comments (for instance a surprised 'that was quite enjoyable' at the end of a test) were generally favourable, reinforcing the positive picture gained from the more formal results.

iv. formal questionnaires

A formal questionnaire was the principal evaluative tool in Xtutor testing. Its purpose was twofold: firstly, to establish a baseline for each test subject – their previous experience, and, to a very limited extent, personal background; and secondly, to discover any effects which followed use of Xtutor.

The questionnaire, which consisted of four A4 sides, was presented in four parts.

The first was a heading and brief introduction. This explained what the test was, and why it was being carried out. It went on to explain how a test subject should complete both the test, and the questionnaire itself. The introduction ended with the comment: 'Your help is much appreciated'. It is usually appropriate to include a similar acknowledgement – everyone likes to be thanked.

The Xtutor questionnaire's second part consisted of only three questions, designed to find personal details of the respondent: age range, gender, and – to clarify responses in a multi-cultural environment – whether their first language was English.

Part three made up the main bulk of the paper. Headed by an explanatory guideline, it listed 35 questions which were answered by giving a 'weighting' from 1 to 5.

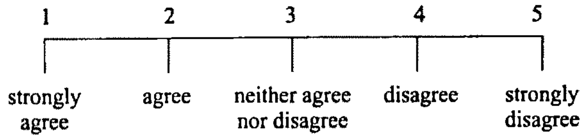

Figure 3 – Xtutor questionnaire guideline

It is important, when asking test subjects to respond to questions of this type, to give them an understanding of what is expected. I feel this is best done by means of a visual cue such as that shown in FIGURE THREE. It is, of course, possible to provide the same effect through a verbal description.

Questions started with requests for the degree of agreement with simple and easy-to-answer queries about the user's personal experience with computers: 'Before this experience, I had not used a computer', 'Before this experience, I had not used a workstation'. Once the method of answering was established, queries moved to direct questions about specific points: 'Text displayed by the Guide XWindows Tutor was always easy to read', 'I found the Guide XWindows Tutor confusing to use', and so on.

The arrangement and phraseology of questions was carefully considered – the language used was always as clear as possible, while important questions were always asked more than once. To avoid obvious problems, a repeated question was rephrased, so that 'The Guide XWindows Tutor did not tell me anything I needed to know' became 'I feel I have gained useful information from the Guide XWindows Tutor'. Comparison of the responses given by the same subject to these 'doubled' questions was helpful in determining the weight to give their answers.

Arrangement of questions was also given thought – a run of questions which anticipated negative (or positive) responses was avoided; so subjects were less likely to just run down a column ticking all the 5s, for example.

The final part of the Xtutor questionnaire provided space for more general questions, encouraging a respondent to provide a fuller answer than was possible with 1 to 5 queries. These final questions were of the type 'The best thing for me about the Guide XWindows Tutor was..', 'The worst thing.... was..'

User input to hypertext design is not always an appreciated resource. 'What changes would you make to the Guide XWindows Tutor to make it better from the user's point of view?' was, however, a question which proved well worth inclusion – it provided some most interesting contributions.

Analysis of the questionnaire, particularly of the 'weighted' questions, provided material which was readily incorporated into a report – and was particularly helpful for graph generation.

v. before-and-after tests.

Although some questions asked respondents whether they felt they had gained from Xtutor use, in the Xtutor tests themselves there was no formal measure of 'before' and 'after' skills. Although it may well have been helpful to have included such testing, the varied experience levels of test subjects and difficulty in establishing a baseline militated against it.

One aspect of Xtutor testing was most interesting, although it may not always be of use in tests of commercial hypertext. This was the inclusion in the testing programme of several different versions of the same hypertext document – in the case of Xtutor, these included a version which had deliberately been made less 'dense' – that is, the levels of information within the document were reduced. A further version limited the amount of information displayed at one time, with the intention of simplifying a reader's task. Comparison of results from identical tests of the 'base' version with those from modified versions permitted the effects of these modifications to be assessed.

Summary

This paper has stressed the importance of developing cost effective and acceptable hypertext, emphasizing the importance of evaluation in this task. I have suggested appropriate evaluation is the key to successful development, and have described methods which may be used in evaluation of hypertext documents. Such testing was illustrated through the example of the Guide Xtutor hypertext application.

Conclusion

Accurately identifying the intended purposes of a proposed hypertext document is only a first step – it is essential to also establish whether or not the hypertext actually achieves its purpose. Appropriate evaluation of the hyperdocument assists in such analysis. Evaluation may be of considerable potential value – money spent on an ineffective hyperdocument is not only wasted in itself, but leads to further costs; the consequences of continued use of inefficient hypertext are depressingly obvious.

Careful planning, including the involvement of potential users in the design process, will minimize problems, but to confirm the efficiency of a completed hypertext document there can be no substitute for systematic testing.

This paper has described some ways in which evaluative testing of hyperdocuments may be carried out. Such testing should have immediate and tangible benefits, assisting the production of more efficient and cost effective hyperdocuments.

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Domesticating the revolution: information and communication technologies and everyday life

Roger Silverstone

University of Sussex, Centre for Information and Communication Technologies, Science Policy Research Unit
Media, Technology and Culture Research Group, School of Cultural and Community Studies

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Abstract

This paper provides an opportunity to reflect on some of the questions that have been raised both in empirical work on information and communication technologies (ICTs) in the household (Silverstone, 1991; Silverstone and Hirsch, 1992) and previous attempts to conceptualize the place and significance of ICTs in everyday life (Silverstone, Hirsch and Morley, 1992). It is intended to raise questions both about the cultural politics of information and communication technologies and, more broadly, about the politics of culture – about information and communication technologies' mediation of public and private spheres. It also raises questions about the nature, direction and speed of the 'information revolution'.

Increasingly it is becoming clear that the core questions surrounding the status of ICTs in everyday life are those to do with power and politics. By this I do not mean simply conventional politics: the politics of regulation, for example, or the politics of the marketplace, important though these are (eg. Garnham, 1991). Nor do I mean the kind of power that some theorists ascribe to media or information technology *sui generis* (eg. McLuhan, 1964) I do not mean the kind of power that yet other theorists grant to institutions in their disciplinary capacity to command language, discourse, knowledge, important too though this is (Foucault, 1977). And I do not mean the kind of power to define the meaning of technology, often romanticized and usually exaggerated, which yet further theorists grant to the consumer-user (Woolgar, 1991).

What I do mean, and what I want to discuss in this paper, is the politics of domestication. And by this I intend the following. The politics of domestication is one which emerges in the interaction of institutional power, technological potential and consumer choice. It is pursued by producers and regulators in relation both to hardware and software through technological design and innovation. It is pursued by advertisers and market makers through their rhetorics of consumption. And it is pursued by consumers who seek to manage and control their own electronic spaces, to make mass produced objects and meanings, meaningful, useful and intelligible to them.

This is a process of domestication because what is involved is quite literally a taming of the wild and a cultivation of the tame. In this process new technologies and services, unfamiliar, exciting but also threatening, are brought (or not) under control by domestic users. They are bought or subscribed to, understood or misunderstood, used or rejected; but in their ownership and in their appropriation into the culture of family or household and into the routines of everyday life, they are at the same time cultivated. They become familiar but they also develop and change. And these developments and changes, the product of the work that consumers do in taking possession of new technologies and services, feedback into the innovation process: diverting it, reinforcing it, sometimes rejecting it more or less completely. This is why the innovation process is so difficult to predict. However in the dynamics of domestication, and in the mostly unequal politics over the meaning and power of new ICTs, it is not, of course, only the technologies which change, for cultivation also involves changes in the cultivator and in his or her culture. What is involved, then, and what results, is the particular quality of the so-called information revolution in any given social, organizational or domestic setting.

This is, of course, the theoretical justification for the kind of empirical work that I and my colleagues have been doing in investigating family and household use of ICTs, but it is also a justification – and this is central to my argument in this paper – for making sure that such micro-sociological investigation of consumption is properly located within a wider politics of production, regulation and marketing. And, vice versa, it is also a justification for the claims that any micro-sociological or economic analysis of the production, regulation and marketing, should properly recognize the significance of consumption in the playing out of the innovation process. Finally, it is a justification for seeing the information revolution, in its presence or absence, as well as the whole process of technological change, as a fundamentally cultural one – indeed one which is the product of cultural politics.

The implications of this position are, I think, reasonably clear. An understanding of ICT related technological change cannot be claimed without understanding in turn the dynamics of production and consumption in specific, international, national, regional, local and domestic settings. The specific utopian visions or dystopian panics that are attracted to ICT innovations like moths to a lamp, are the product, of course, of the failure to take into account the dynamics of acceptance, resistance and continuous negotiation as they are played out within the structures and patterns of everyday life. Indeed the uses of ICT in everyday life, and the consumption of its machines as well as of its meanings, is neither a passive nor a decontextualized one. We have begun the investigation of the embedding of ICTs in the social and cultural spaces of the domestic setting. Others have looked at institutions and organizations. But, as I shall now suggest, the location of use – in this case the household – has itself to be understood more widely. The household is not only a complex social and cultural institution within which decisions to accept and reject new technologies and services are made, but it is also a complex social and cultural institution which is itself changed by its participation in a wider technologically mediated politics and culture.

But in what ways? And how evenly? Claims of information and communication technologies' capacity to integrate households into an electronic network of instant access, permanent pleasures, enhanced efficiency and space-time hyper-realities (as well as fears of the obverse) have to be set against the base line inequalities of cultural and economic capital – competence, skill and desire as well as money. These inequalities of competence and access will be structured by age and gender as well as by class or location. But these claims also have to be set against another base line: the particular politics and economics of ICT that the State and the market together define, and which are mobilized in the various rhetorics of public policy and information, advertising and marketing.

The key question is understanding and relating these two different base lines. I want to propose that an investigation of what I mean by the domestication of ICT may help us in this task, at least as far as understanding the place and significance of ICTs in everyday life is concerned.

In the remainder of this paper therefore I want to do three things. I want to explore the ramifications of the notions of the domestic and domestication in such a way as, hopefully, to provide a way of thinking about the dynamics of technological change in everyday life. Then, and by way of illustration and extension of the argument, I would like to focus on some of the implications of recent work with teleworking families and households. And finally, and extremely briefly, I would like to relate some of the issues raised to questions of European policy and research.

How does the domestication of information and communication technologies occur?

How does the domestication of information and communication technologies occur, and what are its implications? The starting point for the discussion is a recognition of the historically defined and sociologically complex nature of our own domesticity, and in particular its differential expression through home, family and household. Home, family and household refer respectively to the phenomenological, the social and the economic aspects of domesticity. I have in previous papers (Silverstone, 1990; 1991; 1993) discussed certain aspects of this, so I will be brief.

Our domesticity is a product of a number of interrelated processes, in each of which, and arguably increasingly, information and communication technologies are involved. Historically the overall shape of that domesticity has been formed as a result of the combined consequences of the social and technological changes associated with industrialization. Raymond Williams described them, in relation to those most clearly associated with the new generation of electronic and telecommunication technologies as the century matured, as a kind of 'mobile privatization'. The new communication technologies (including literally such communication technologies as the tram, the commuter bus and train services and the car) provided a means whereby households could, and did, disperse away from the cities while remaining connected both to those cities and to each other. We can argue that this movement of dispersion and connection has continued and that ICTs are material to its albeit contradictory progress. We can also see these changes in the interrelationships between geographical and cultural change: in the dispersal of populations; in the increasing suburbanization of culture; and in the privatization of our domestic lives. And once again ICTs are often seen as central.

But we can also recognize how that domesticity is itself a complex of different dimensions. As a phenomenological, cultural, reality it is grounded in a sense a belonging, security and identity, and defined, as geographers have noted, in 'the horizons of reach'. Home is not only where the heart is, but it is the basis for our capacity to extend our individuality: physically, socially and imaginatively. Home is the place to which we return. It has been suggested that ICTs have fundamentally affected what we mean by home. Some have argued that they have contributed to its undermining, creating a new kind of rootlessness, because they have the capacity to unlock, disconnect and decathect individuals from their dependence on place (eg. Castells, 1985). Others have suggested the reverse: that ICTs, from the telephone, to the television, to the computer have liberated our domesticity from its dependence on physical location (eg. Toffler, 1980). Anthony Giddens' notion of 'space-time distanciation' is one which recognizes, as many others have done, the paradoxical capacity of ICTs both to globalize and localize (Giddens, 1990).

Yet once again we must be careful. For not only did the process of extending reach begin long before the present generation of ICTs, as Walter Benjamin (1976), writing of the emergence of the private citizen under

Louis Philippe, noted, but it is also not simply a matter of a uniform process. As Doreen Massey (1992) and Marjorie Ferguson (1990) have separately argued, these dramatic transformations have yet, in their most recent manifestations, substantially to transform the lives of most of us.

I too argue for caution, for it is precisely in the localized negotiations of technological potential, as well as in the force of an industrial and political agenda, that we need to understand even these phenomenological dimensions of our domesticity.

The term family stands for a whole range of sociologically disparate relations that can be found within domestic life. But it also stands, literally, for the nuclear family as it has been defined and legitimated through generations of bourgeois culture. The family is an ideological notion to be sure, but precisely because it is so, it remains, in all its contradictions, pivotal for any examination of social relationships conducted in private. Our initial research certainly took this position, and I think properly so. Our current work is investigating ICTs in the households of lone parents.

One can note that ICTs are involved in 'family life' in two ways. They are constructed in use: through the gendered and aged politics of the family; and in the management of, or conflicts over, space and time. Through these patterns of use, ICTs can be used as markers of territory or status or power. Equally, decisions made on new purchases of machines or services, as well as the ways in which programmes are watched, computer software used, and telephone conversations conducted, are dependent on the specific structured patterns of everyday life inside the household. But there is another dimension to the relationship between ICTs and families. It lies in the content of the media's own messages, and in particular in the representations of family life that are omnipresent in soap opera and situation comedies, and which, as many commentators have argued, have often been motivated by a more or less articulated desire to support or re-establish (after the disruption of war-time for example) family values (eg. Spigel, 1992; Haralovich, 1988). Here are ICTs being doubly articulated into family life: as objects and technologies to be formed and as media which form as well as inform.

Families and other social units live in households. The household is the economic unit through which the private is articulated with the public sphere. The household is the resource system, in which both symbolic and material resources are mobilized for the engagement with the outside world as well as internally. We have described this aspect of domesticity as a moral economy (Silverstone, Hirsch and Morley, op.cit). It is an attempt to characterize, synthetically, the household's capacity to create for itself, and sustain, a particular kind of economic rationality that might not necessarily coincide with that which dominates in the public world of formal economies and instrumental transactions. The economies of households are informed by the particular values and practices, in turn the product of the biographies, histories, cultures and circumstances of its members, which define – more or less – their integrity as functioning units.

The moral economy is also, finally, relevant to the domestication of ICTs for it is in the transactions that households generate in their relationship with the world beyond their front door that the meanings of technologies – their status in the home, and the extent of their influence on the daily lives of family members – are defined. It is through the dynamics of these daily transactions: in the ordinariness of everyday life as well as in the heightened and less frequent moments of ritualized or exceptional activity – on birthdays, or at Christmas, for example, that the particular character of the household's role in the domestication of ICT must be sought. Let me pursue this a little further.

Perhaps the most important point to make is that none of these different dimensions of our domesticity – home, family, household – can be understood apart from the social and historical circumstances of their creation and maintenance. Equally none of these different dimensions can be understood apart from the various social, technological and cultural networks that lock a given household into the constantly shifting structures of everyday life.

This is not just a matter of context. It is a matter of recognizing the mobile and uneven nature of the boundaries around that domesticity, their relative perviousness or imperviousness to influence; and it is a matter of recognizing that our domesticity is produced in specific cultural spaces that both constrain and challenge as well as sustain and encourage. That domesticity is vulnerable to changes in the technological environment of course, but it is also, and arguably, more significantly vulnerable to changes in demography, economic cycles, or political fashion. Our domesticity is not therefore to be counterposed to a different world outside or beyond it, which provides merely a context for its definition. It is itself constituted in a constant and dialectical interrelationship with that outside world.

Media and information technologies are central to this dialectic. And it is in the processes associated with their domestication that we can begin to understand the particular dynamics of technological innovation, and cultural and social change. This is, parenthetically, once again a central justification for the kind of micro-sociological research that we have been conducting, for it provides an opportunity to examine how ICTs are both products and producers of shifts in our domesticity. But also, I think, it provides a stimulus for a more extensive research agenda which should seek to integrate studies of the regulation, production and consumption, and, crucially, the marketing of ICTs within specific social and historical settings. I will return to this suggestion at the end of the paper.

The domestication of the information revolution is undertaken at the interface of public and private spheres, and formal and moral economies. In earlier papers we have tried to provide a model for this which specifically sought to address the particular dimensions of the process by reference to the ways in which technologies, objects and meanings are appropriated into domestic space. That appropriation, we suggested, involved households in a number of different stages through which newly acquired technologies and services were accommodated. It was an account which saw the centre of gravity for this process very much in the activities of consumption: in the actions of buying, and using and fitting new machines and media into the often contested temporal and spatial dimensions of the home, as well as integrating and displaying that more or less successful adoption through visual and verbal display both inside and outside the home.

There are a number of problems with this model as it was originally formulated. Central amongst them was its failure adequately to recognize the strength of the strategic processes of prior definition to which technologies are subject both in production, and most especially in their commodification through marketing and other forms of public definition. If we take the notion of consumption literally, for a moment, then it seems quite clear that ICTs and services are, in some degree, always predigested. Consumers are confronted not with a technology in its nakedness but with an idea, a dream, a promise that advertising and marketing or public policy creates (Skinner, 1992). Consumption in this sense is anticipated, as James Carrier (1990) points out, in the various strategic pronouncements and campaigns of relevant industries or governments.

This is not to say that patterns of use are determined by such design and market messages, nor is it to say that the texts which are constructed around technologies in the public sphere are infinitely negotiable in consumption (this may be theoretically true but it also often empirically insignificant). What it does say is that it is necessary to interpose another crucial dimension in the dialectical process, which is relevant to the consumption of ICTs as much as to any other object. This requires, in turn, that consumption be seen as a rhetorical activity, and in so far as it is a rhetorical activity it is, significantly, a political one. The politics of the consumption of ICTs and the rhetoric of consumption is expressed in the various ways technologies are constructed by those institutions who have the power to do so. Radio was implemented as a broadcast technology not as a means of interpersonal communication. Differential telecoms tariffs predefine how new services will be used and by whom. The Conservative government's strategic policies on ICT in the early 1980s created an expectation that the home computer was the deus ex machina of social change and personal development. New ICTs for the domestic market are subject to constant and often contested definition and redefinition in design, advertising, marketing and the secondary discourses of specialist magazines and consumer guides. But these rhetorical bids are just that – rhetorical. They claim but they do not determine. And in their indeterminacy there is space for creative consumption that can, and does, go both with and against the grain.

Teleworking provides an excellent and timely example of much of this, since it is increasingly being put on a public agenda, both in this country and across Europe. Major studies are being commissioned. Journal articles are being published. Consultancies are springing up. *The Independent on Sunday* has recently devoted three successive weeks of its property pages to the phenomenon. The economic, environmental and social arguments are coalescing compellingly, and the benefits, in terms of efficiency and quality of life, are being trumpeted loud and clear (eg. Kinsman. 1987). Here is a new dimension of the information revolution, if ever there was one (though perhaps not so new, since futurists have been extolling both its potential and its inevitability for years).

At the heart of teleworking, and what distinguishes it from other forms of homework, of course, are the technologies and the capacity of those technologies to connect: to connect the dispersed workforce to head office, and perhaps more importantly head office to the workforce; to connect the dispersed worker with colleagues and clients; to connect the terminal to an equally dispersed but constantly available network of data and expertise. And through all of this the teleworker, both employed and self-employed, is perceived to be empowered (though equally, some have argued, disempowered, by virtue precisely of the dispersion), especially through his or her control of time.

Teleworking households

During the last year Leslie Haddon and I have been studying teleworking households with a view to understanding better the particular dynamics of the incorporation of this relatively new form of work into the home (Haddon and Silverstone, 1992; 1993a; 1993b in press). We have been concerned, too, with the implications of its arrival for the use of ICTs more generally, and of course we are particularly concerned with the possible shifts in domestic culture, both internal to the household, and in the household's relationships to the outside world, which result. What I want to do here, though relatively schematically, is to draw out some of the issues and questions that this study in particular has raised in the light of the more general conceptual framework that I have just outlined.

My point in doing so is this. Very crudely it is to say something about what happens, and why, when the information revolution – in the guise in this case of teleworking – meets the spongiform structures of our domesticity and everyday life. It could be argued that we are, at this moment, on the cusp of a further twist in this so-called revolution. How does it manifest itself? How is it being, and how might it be, domesticated?

I want to suggest that the arrival of teleworking into a household does indeed shift things. It brings with it particular demands on the organization of time and space within the home. It can and often does involve a restructuring of domestic life and of the moral economy of the household in such a way as to suggest that something quite fundamental is going on: in terms of the relationship between home and work, and especially in the kind of domesticity that is created. This is obviously the case for individual households but may also be the case more generally as this form of work organization spreads. I want to suggest that teleworking (but how much more or less than other forms of homeworking?) does involve a technologically inflected (though not inflicted) hybridization of domestic space, especially in so far as it offers the possibility of a significant restructuring of the relationship between home and work.

But in saying these things – and in acknowledging too that the arrival of teleworking technologies has consequences for attitudes towards, demands for, and uses of, ICTs elsewhere in the household – I still want to insist that the course of true revolution does not run smooth. Here too, even where technological change is overdetermined by the insistence of either employed or self-employed work – and it is this insistence rather than the force of technology which is compelling – the issue is far from straightforward or uniform. Teleworking is a matter of domestication no less and no more than other objects of consumption in family households.

The space between insistence and resistance is defined by a complex pattern of motivation, degree of technical skill and competence, economic power, gender, professional status and stage in the family life cycle. It is defined too by the politics of the household, which is once again a product of gender and generation. Teleworking can be a motivated or an enforced work option. It can be temporary. It can be partial. It can, and often does, involve a wider support network of family or neighbours.

The arrival of teleworking, whether anticipated through the previous presence of computers in the home or through other forms of homeworking, or as something quite novel, still has to be accommodated into a well established structure of social relations that involve most often, and especially, a gendered division of labour. It comes as really no surprise to observe that these established patterns of domestic life are relatively inflexible and resistant to change, even when one member of the household attempts to carve out time and space for the organization of work within the home. Men and women at all levels of professional involvement maintain their relative positions in the family. Male teleworkers can much more easily command resources, of time and space and support, irrespective of the status of their work. Female teleworkers still have, in the main, to plan their working lives around the persistent demands of domestic life for which they continue to have more or less full responsibility. Clearly no information-led revolution here.

Yet in making this general point it would be a mistake to insist that these domestic structures are impervious to influence, and rigid in response. Families and members of households adopt a whole range of strategies to manage telework, and as others have shown in relation to control over leisure based ICTs, the politics of the family or household is crucial in understanding the particular dynamics and balance around the use of teleworking technologies and the organizational life that is constructed around them. There is, too, much evidence in our study both of a kind of mutuality of support within the household (as well as in some cases some barely concealed hostility) as well as an integration of the teleworker into a number of more or less informal networks outside. The mutuality of support ranges from the male shift worker who uses his time at home to help his teleworking wife, for example, with document printing (but also the female partners of teleworkers maintaining the household and child care despite the continual presence of Mr. T.W. at his terminal in the front room) to an integrated high-technology working environment which involves both husband and wife almost equally.

Networks also vary in character, but function generally to provide a kind of compensatory social structure, compensating, perhaps, in different ways across gender lines. These provide women with a more or less enhanced version of family and neighbourhood based networks that support traditional home-based activities. And they provide the male teleworker, a plausibly 'feminine' set of networks to support – professionally, socially and technically – his novel status and unfamiliar isolation.

In this process of social acceptance, adjustment, compensation and resistance – of which I have only been able to give a merest impression – teleworking and the technologies that support it – either new or both functionally or spatially repositioned – are each subject to the kind of domesticating processes I have already identified. Institutional demands on the employed teleworker, more diffuse but often equally or even more insistent market demands for the self-employed, technological potential and domestic response, combine in a more or less visible, more or less invisible, politics to define particular individual and collective solutions to the revolutionary claims of this new form of work.

The particular meaning and place of telework supporting ICTs is also negotiated through this politics. Multi-functional machines are still under-used. Household priorities limit upgrading even when work is being lost as a result. Old machines seep into the domestic spaces to be used for other household or leisure based uses. Telephones multiply: new lines, new answerphones and answering services as well as new conflicts and new rules of access and use emerge. Teleworking does appear to provide a faster track towards a denser technological culture for the household. It also appears to be offering a new kind of domesticity which, even in its integration into existing domestic arrangements, shifts the whole moral economy of the household towards a greater instrumentality. The organization of work, its temporal and spatial demands, as well as the creeping functionalism associated with the uses of new technologies affect the patterns of everyday life in the home, producing a secondary domesticity which echoes forms of pre-industrial experience.

All this is grist to the domesticating mill. What it illustrates, I think, is something of the social and cultural complexity associated with the process of technological, and technologically related, innovation. It also reveals, in a particularly intensive way, how the interrelationships of technology, institutional demands, public discourses and consumer responses combine to alter the boundaries around the household, and to determine the indeterminate patterns of ICT use in everyday life. And of course vice versa. Those social, cultural and economic changes combine to provide an environment in which new technologies gain their sociological spurs and their domestic status. In so doing the particular relationship of public and private spheres, and the household's participation in the world of public meanings is also affected. Through the command of electronically communicated images and sounds, through access to immediate and specific information, through increasing engagement in multimedia and interactive forms of albeit leisure-oriented media, the horizons of our reach are extended, though arguably and, paradoxically perhaps, also weakened. The politics of the household and the politics of ICT are matters not just for struggle between family members, however significant these may be. They are also, and crucially, fought out in the struggles over access to, and control over, the technologies and their meanings themselves, struggles that are waged in and through consumption, at the place where regulatory and market structures, technological potential and user choices meet.

And if we are right to see the various developments in and around teleworking, as well as the particular constructions of ICT which are associated with these developments, as being so underdetermined by the combined forces of institutional and market pressures and technological trajectories, then how much more likely is it that without the first – that is without the instrumental pressures associated with work – the routes of technological and social change would be even more diffuse and difficult to predict?

Teleworking provides an excellent case study for exploring the domestication of the information revolution, for it suggests that even at its strongest – and most overdetermined as far as the household is concerned – technology-linked changes are subject to significant variation in scale, scope and speed, once they confront or enter domestic space. Teleworking does offer new opportunities as well as challenges to family households, but one wonders how far it is the appearance of work rather than technology in the home that is the key factor. If this is so, then we can see how ICT's role is mediated once again, and we therefore see how important it becomes to look at the politics of work and the politics of public discourse as well as the politics of the household if we are to understand better the powers behind, and the dynamics of, technological change.

This must be even more the case on the wider scale, where the future and impact of new ICTs across the board is at stake. It must also even more be the case if we take a wider geographical and geopolitical canvas and look at the European situation. Here it seems to be even more important that we make the argument for a political sociology of technology. EC policy making in and around ICT has historically been almost entirely technology based. Even macro-economic analysis, though unsurprisingly, works with models that have a kind of techno-instrumentalism ground into them. There is no, or very little, sign that the complex processes of innovation – and their domestication – in and through the structures and practices of everyday life, are being seen as in any way relevant either to policy making or market shaping across Europe. There is little or no consciousness of the fact that technological change is a social and cultural phenomenon, and as such varies across nations, regions and locales. And there is, finally, little or no acknowledgement, that the future of information and communication is just as likely to be forged on the anvil of everyday life as it is in the minds or laboratories of engineers.

The domestication of technology in and through the practices of everyday life, is therefore a politics of technology which involves active negotiation with the publicly defined meanings – instrumental meanings and symbolic meanings – of new technologies. It is conducted on the spot where institutional and commercial power, technological potential and consumer choice meet. It results not in a technologically or even a market-driven innovation process, nor in a process of diffusion in which users and consumers are merely instruments of forces beyond their control, but in a negotiated and underdetermined process of technological and social change. We need to take into account, and understand much, much better than we do now the nature of these processes if we are satisfactorily to grasp the nettle of technology's future in everyday life.

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Electronic serials for library and information specialists on Internet

Jagtar Singh and Jack Meadows
Loughborough University of Technology, Loughborough, Leicestershire, LE11 3TU

Abstract

The amount of online information and discussion relevant to library and information activities has expanded very rapidly recently, particularly as a consequence of the development of Internet. The results are presented here of a detailed survey of the coverage Internet provides concerning the work of library and information specialists. The intention has been both to determine what is available and how best to access services from the UK. Especial emphasis is placed on the availability of relevant electronic journals.

Introduction

Networks were created to permit the interchange of information between remote computers. They were typically established initially either to satisfy particular information needs, or to cover specific geographical areas. Over time, networks have tended to link up, so allowing for the transfer of information nationally and internationally. JANET, which mainly connects higher education and research establishments in the UK, is an example of such national growth. BITNET is a well-established international network, now linking several thousand computers in nearly forty countries round the world. This hierarchy can be extended: Internet is a network which links networks, rather than individual computers. Being at a higher level necessarily means that Internet has greater potential for information transfer. It now covers several hundred networks and, correspondingly, several hundred thousand computers. (For an excellent survey of Internet and its services, see Krol[1]; a briefer, but easily accessible review has been provided by Watson[2]; an online guide has been provided by Dana Noonan[3].)

Besides this inherently greater outreach, Internet has become an increasingly flexible way of accessing networked information. BITNET has been primarily aimed at electronic mail and person-to-person file transfer. Along with similar capabilities, Internet also offers remote log-on and FTP (file transfer protocol) facilities. In addition, interaction with Internet, using the facilities now available, is typically faster than with BITNET.

This increasing flexibility has both extended access to information sources, and encouraged the presentation of new information. The present article is concerned with identifying which electronic serials now available are aimed specifically at library and information specialists. The emphasis here is on availability over Internet. Although a number are available in other ways – especially over BITNET – it is Internet which is giving access to them its current impetus. The article is written from the viewpoint of someone in Western Europe accessing what are mainly US resources. It is obviously a shot at a moving target, not only because new US sources are constantly being added, but also because other countries are quickly moving down the same path of flexible provision of networked information.

There is an additional problem of definition. What is an electronic serial? This question has been discussed by Bailey[4], who argues that computer conferences should be included under this heading, along with electronic journals and newsletters. We have followed his suggestion, but feel that the distinction between discussion groups, bulletin boards, computer conferences and newsletters is now becoming so blurred that all of these need to be seen as linked. Our concern in this article is with services that do not require explicit payment. (It may be noted that there is a current debate in the USA on whether use of Internet should incur charges.)

Internet facilities

The facility for anonymous log on, using Internet, to a range of hosts permits the downloading to the user's computer of files available on other computers. Many of these are accessible via electronic mail and anonymous FTP (i.e. the host recognizes 'anonymous' as an identifier and the user's electronic mail address as a password). The problem lies in identifying what is wanted from the vast array of accessible sources. For files, a very useful system is Archie, run by McGill University in Canada. This provides an index to the files readily accessible over Internet. Once a month, the system determines what generally accessible files are held on computers throughout the network. The index, thus compiled, can be searched via keywords or strings. Appropriate files, once identified, can then be acquired using anonymous FTP.

A major reason for the current upsurge of information handling on Internet has been the development of a simple, but wide-ranging method of searching for information – the gopher (For a good recent review, see Wiggins[5]). A gopher is a form of distributed information delivery system: more specifically, it is an Internet tool designed to help users access a variety of online resources. Basically, a gopher allows searches of menus across the Internet system; this can be followed, if desired, by access to the resources listed in the menus. One of its significant advantages is that it provides access to different types of resource automatically, without requiring additional manipulation by the user. Gopher started as a distributed information service on the University of Minnesota campus, acquiring its name from the fact that it was designed to 'go fer' items of information. From there, use of gophers on Internet has expanded rapidly: it is becoming one of the most frequent ways of using Internet. As will be noted, various facilities are currently being developed to ease the search for information via gophers.

WAIS (Wide Area Information Servers) provides a complementary, if more limited, way of accessing information. It searches indexed text only: keywords are used to sort retrieved documents in order of priority by means of weighted scores. Though by no means all the text on Internet is covered, a wide range of specialist indexes are now available. In discussing access to electronic serials, however, we will concentrate here primarily on what is often called 'gopherspace'.

Gophers and related systems

Gophers can be divided into the general and the special ('subject' gophers). The latter are obviously intended to help users concerned with a particular topic. For example, users concerned with ecological information might first consult Ecogopher at the University of Virginia. General gophers allow browsing more widely, which may lead to less obvious sources of information not included in the specialized gopher. In any case, not all aspects of a specialism are necessarily brought together by a specialist gopher.

Probably the most useful specialist gopher for library and information workers, because of its breadth of relevant sources, is Infoslug. It is based at the University of California, Santa Cruz. This is discussed in some detail below to give some idea of the layout of a typical gopher. To access such a gopher requires an Internet account. The system is activated by sending a telnet command of the form '% telnet scilibx.ucsc.edu'; login 'gopher'. The following menu then appears:

1. About UCSC InfoSlug
2. The Academic Divisions
3. The Campus
4. The Classroom
5. The Community
6. The Computer Center
7. The Library
8. The Researcher
9. The Student Center
10. The World

Selecting 7 on this list leads to another menu:

1. About Library Services and Collections
2. Check Circulation Status of Books
3. Electronic Books and Other Texts
4. Electronic Journals
5. Electronic Newspapers
6. Electronic Reference Books
7. Indexes and Abstracts
8. LAUC (Librarians Association of the University of California
9. Library Hours
10. Library Tours and Orientation Schedules
11. Media Center Resources – Film, Video, Audio, Cable TV
12. Melvyl Library System
13. Other Libraries
14. Research Guides and Bibliographies
15. Reserve Reading Lists
16. Selected UCSC Faculty Publications
17. UCSC University Library FACULTY NEWSLETTER

Selecting 4 provides an excellent introduction to electronic full-text materials relating to research in North America. There are four screenfuls of headings, the second of which is reproduced below.

19. Cornell Theory Center Technical Reports
20. DECNEWS.DIR
21. Data Entries (Texas Woman's University Libraries)
22. EDUCOM Documents
23. EJournal
24. Economic Bulletin Board
25. Electronic Antiquity: Communicating The Classics
26. Federal Register (U.S.)
27. High Energy Physics – Phenomenology (preprints)
28. High Energy Physics – Theory (preprints)
29. Human Resources News (UC Santa Cruz)
30. Humanities Journals & Newsletters
31. Internet Business Journal
32. Issues in Science and Technology Libraries
33. Journal of Technology Education
34. LC Cataloguing Newsline
35. Library Journals & Newsletters
36. Literary Anthologies

Finally, inputting 35 leads to the following list of library-oriented material.

1. ALCTS Network News
2. Automatome
3. Current Cites (Information and Library Studies)
4. Meckler Publishing
5. Network News
6. PACS News
7. PACS Review

Besides Infoslug, a number of other gophers and non-gopher systems carry material of interest to library and information workers. For example, the 'Virtual Reference Desk' can be accessed at the University of California, Irvine, via Infoslug. This provides access to a wide range of relevant information. CARL (Colorado Alliance of Research Libraries) is an example of a system that is menu-based, but not a gopher. It provides access to five categories of information – library catalogues; current article indexes and access; information databases; other library systems; library and system news. Uncover, an interdisciplinary index covering several thousand academic journals, appears under the 'current articles' heading, along with a facility for article delivery, but is only available on subscription. CARL can also be accessed via the NISS gateway in the UK. The 'other library systems' category includes access to MELVYL, the full library catalogue of the University of California. This last item is, of course, also available via Infoslug and the NISS gateway. An appreciable overlap in contents between gophers – and between them and non-gophers – is the rule, rather than the exception.

Another relevant gopher is CICNET, based at Ann Arbor, Michigan. It is particularly concerned with developing a centralized archive of electronic journals and newsletters. An online announcement in November 1992 explained:

> 'An increasing proportion of [electronic information] is supplied through the rapidly expanding numbers of electronic journals and newsletters ... It has ... become clear that we cannot depend on producers of these electronic forums to maintain full archives of the title, any more than we have been able to count on print publishers to maintain a historical archive of their works. Therefore, it is most important that these texts be collected and permanently archived in their most extensive form in order to maintain both working sources and the historical record'.

With gophers, the name of the system is not necessarily indicative of coverage. For example, one of the most useful servers to access is the Washington and Lee Library Guest Site. Despite its name, this gopher allows access to most Internet sources of interest to library and information workers. It actually provides two types of menu access to library catalogues.

The first is the typical menu-based approach used by Infoslug; the second, via Hytelnet, is a hypertext-based approach.

Other systems, though less wide-ranging, may have interesting information on them. Free-nets are an example. Thus the Cleveland Free-Net is a system on the National Public Telecomputing Network (NPTN), which is intended to encourage community computer systems throughout the United States. It carries such local items as the activities of the Cleveland Chapter of the Special Libraries Association, on the one hand; on the other, it has international links, e.g. to the CoSy conferencing system for educationalists, based at the University of British Columbia. En route it also provides an electronic bookshelf (with access to the Electronic Bible, the Electronic Koran and the Electronic Book of Mormon). As part of a two-year pilot project (Project Hermes), the Cleveland Free-Net makes available US Supreme Court opinions as soon as they have been formulated.

The great virtue of gophers is that they make movement across the system easy. Resources of all kinds distributed over a variety of hosts can be accessed with a single set of commands. Though each gopher server has its own set of menus, the level of interaction permits easy browsing from one to another. The gophers typically provide users with a directory (essentially menu-based) approach to information, but also allow other forms of interaction. (Some items are marked as indexed directories: it is possible to carry out simple keyword searches on these.) Another possibility is to establish telnet connections to resources outside a gopher. For example, the bulletin boards section on Infoslug mentions the British bulletin board BUBL. This can be accessed via telnet, if desired. Menu items are sometimes flagged as text files. These can be accessed in the usual way via the menu, but can be downloaded. Finally, a few gophers permit files to be retrieved from anonymous FTP servers (though the way this is effected by the user may vary with the gopher concerned).

Gateway Services

Devices are now becoming available to assist searching across gopher servers. Towards the end of 1992, Veronica (Very Easy Rodent-Oriented Netwide Index to Computerized Archives), developed at the University of Nevada, came into operation. It can search document titles via keywords across many gopher servers. In Spring 1993, another gopher title search tool, called Jughead (Jonzy's Universal Gopher Hierachy Excavation and Display), became available from the University of Utah. It is being used to create indexes by document type. However, whichever gopher server is accessed, it is possible to move through it to other servers and to the variety of information they encompass. Remote login to Infoslug, for example, will provide an entry to the other systems described here. It might be argued, therefore, that it is only necessary to know how to access one system. Against this, a regular user of gophers soon becomes acquainted with failures to access the system. This may be because the network cannot be reached, access is denied, it proves impossible to connect to the remote host, there is a server error, or the connection is timed out. These problems can sometimes be circumvented by accessing a different server. One common difficulty is that responses are slow because of the number of users logged onto the system. For British users, a California server is good because the difference in times means that US traffic is reasonably light in the morning. Even so, it is possible to remain stuck in the system, unable to exit, for some time, if you are unlucky.

The most obvious intrinsic drawback of gophers is their use of a menu-based system. Some gophers, including Infoslug, now allow the user to input an 'm' in order to return to the main menu, but, in some other systems, a user who has worked through a series of menus to reach a particular item of information will then have to work back though the series to initiate the next piece of data-gathering. In any case, moves sideways from part of the way through one menu to part of the way through another are nearly always impossible. Another problem with some systems is that there may be login and password requirements which are unavailable to casual users. Then, of course, some services are restricted, or are available only on a pay basis.

World-Wide Web (or WWW, or 3W)

As mentioned above, a hypertext interface is beginning to be offered on Internet as an alternative to menu-based interfaces. Much of the initial work on this has been carried out at CERN (the European high-energy physics laboratory). Hence, the easiest way of getting into WWW is via a telnet message to 'info.cern.ch'. The immediate obvious virtue of the system is that links (indicated by numbers in brackets) can go in any direction, and can therefore be both quicker and more flexible than menu-based links. It can also be downloaded and run locally.

For library and information workers, the most useful aspect of the system is likely to be the Hytelnet list of online library catalogues (plus assorted additional information, e.g. about library bulletin boards). It provides an alternative means of access to this information for those who require the extra flexibility offered by hypertext. The list was put together and is maintained by the University of Saskatchewan Libraries. The system provides a simple uniform interface (whereas gophers vary), but it is necessary to log on specifically at each site where information is sought, which entails jumping out of WWW. But the hypertext approach can offer additional facilities that might be attractive to some library and information specialists. For example, users can add their own (private) notes to information on the Web, given access to the necessary software.

Electronic serials

Strictly speaking, the term 'electronic serials' should only cover electronic journals, abstracting journals and newsletters, but, as we have noted above, there is actually a rather blurred borderline separating such serials from bulletin boards, discussion groups, or computer conferences. Serials may contain full-text articles, abstracts, news items, letters, etc., and, as with print publications, a particular electronic publication may consist mainly of one of these items, or of a mixture. Other key factors include whether the publication is charged for or not, and whether or not it is refereed. It is, of course, essential for library and information specialists to keep up with this rapidly expanding area of electronic publication in order to assist their clients. We look first at how to track down electronic serials, and then, specifically, at the titles dealing with library and information matters.

Michael Strangelove in Ottawa maintains a list of electronic serial titles which he tries to ensure contains only active publications. (Electronic publication is a field in which ventures come and go rapidly.) His list is published in print along with Diane Kovacs' list of scholarly electronic conferences, as the *Directory of electronic journals, newsletters and academic discussion lists.* (The publisher is the Association of Research Libraries in the USA.) The third edition, produced in 1993 contains 240 electronic journal and newsletter titles along with 1,152 scholarly conferences. This is a 60% increase since the second edition of March 1992 (which was, itself, two and a half times larger than the first edition of July 1991). The online version can be accessed by several gophers (including Infoslug) and is available on BUBL. It can also be retrieved via electronic mail.

Another directory of particular interest to library and information specialists is maintained by Charles Bailey Jr. at the University of Houston. This is *Library-oriented lists and electronic serials* (with 'lists' here meaning 'computer conferences'). The entries give the serial title along with the address to which online subscription requests should be sent (and information on back-issue files). This guide can be accessed via BUBL.

Electronic journals

The eight electronic journal titles likely to be of most interest to library and information specialists are: *E Journal*; *Electronic Journal on Virtual Culture*; *Electronic Journal of Communication*; *Interpersonal Computing and Technology Journal*; *Issues in Science and Technology Librarianship*; *LIBRES (Library and Information Science Research Electronic Journal)*; *MC Journal: the Journal of Academic Media Librarianship*; *PACS-Review (Public Access Computer Systems Review)*. Basically these are 'listserv editions', but can be accessed via gophers and ftp sites (e.g. ftp (dewey.lib.ncsu.edu), or via retrieval of the necessary commands from Bailey's guide. These journals share three characteristics. They are (1) distributed via electronic mail; (2) do not charge for access; (3) are peer-reviewed.

The *E Journal* is produced from the State University of New York at Albany. Its masthead says that it is concerned with 'the implications of electronic networks and texts', and this is amplified later as implying a particular interest in, 'theory and practice surrounding the creation, transmission, storage, interpretation, alteration and replication of electronic text'. According to a note from the editor, the journal was intended originally, 'to address the ways that computers affect writing. The focus was to be on texts, discourse, language and rhetoric, and the reciprocities of creating and interpreting'. These topics are still of prime importance: an article on children and keyboards led to the production in 1992 of the first 'letters' issue. A panel of reviewers examine proposed contributions, which may cover original articles, letters, reviews or supplements to items already published. The background to the establishment of the journal has been described at some length by the editor, Edward Jennings, in another electronic journal (*The Public-Access Computer Systems Review*, *2*(1), 1991).

The *Electronic Journal of Communication* also appears in French as *La Revue Electronique de Communication*, and is therefore typically abbreviated to *ETC/REC*. It is a peer-reviewed journal, edited in Canada by James Winter at Windsor University and Claude Martin at Montreal University. The first issue appeared in 1990 and the journal places a particular emphasis on media communication. The articles are typically grouped together in special issues. For example, the first issue in Volume 3 was devoted to 'Women and media in Canada', whilst the second issue concerned 'Computer-mediated communication'. A contents list and brief abstracts are accompanied by instructions on how to access the full text of each article. In the 'Instructions for authors' it is stated that, '*EJC/REC* is devoted to the study of communication theory, practice and policy. Manuscripts reporting original research, methodologies relevant to the study of human communication, critical syntheses of research, and theoretical and philosophical perspectives on communication are welcome'.

The *Electronic Journal on Virtual Culture* (*EJVC*) is sometimes called the *Arachnet Electronic Journal on Virtual Culture*. It has extensive peer review: all submissions receive at least three blind reviews by a jury of referees. It started in 1993, with Ermel Stepp at Marshall University as Editor-in-Chief and Diane Kovacs, at Kent State University, as Co-Editor. The journal, 'fosters, encourages, advances and communicates scholarly thought on virtual culture'. Virtual culture is subsequently defined as: 'computer-mediated experience, behaviour, action, interaction and thought, including electronic conferences, electronic journals, networked information systems, the construction and visualization of models of reality, and global connectivity'. Unusually, it promises to acknowledge receipt of an article within 24 hours, and to notify acceptance or rejection within 30 days. The initial intention is to publish monthly.

Interpersonal Computing and Technology is a peer-reviewed journal published from Georgetown University. The first issue appeared in January 1993, and contained a long article on 'The electronic library in higher education: an overview and status report' together with a number of abstracts (with information on how to acquire the full texts online). There was also a short description of how the journal originated (at the Center for Teaching and Technology in Georgetown) and its coverage, which includes, 'the use of electronic networks in the classroom; electronic publishing; the use of electronic networks and information exchange; library applications of electronic communication; professional relationships carried on via electronic communication; and perspectives on the use of electronic communication in higher education, business, industry and government'. The second issue (it is coming out quarterly) introduced the idea of a 'Publisher's Forum' – a contribution to the journal designed to stimulate discussion.

Issues in Science and Technology Librarianship is published for the Science and Technology Section of the Association of College and Research Libraries by the University of New Mexico, and is edited by Harry Llull. The contents are mainly aimed at initiating discussion on current problems of science and technology librarianship. A recent issue notes that all of the back issues are now available on the gopher at North Carolina State University, with the text keyword searchable. This gopher can be contacted via most other gophers (by looking for North Carolina State University Library gopher). The contents of the publication cover news, information about relevant conferences and original articles on science and technology libraries and materials.

LIBRES is an interesting example of the blurred demarcation between different types of electronic communication. For it claims both that, '*LIBRES* is a computer-mediated conference to facilitate and foster research in library and information science and thereby the development of our knowledge base', and that, '*LIBRES* is an e-mail based electronic journal'. The link is explained in the following way:

> '*LIBRES* will be a platform for initiating, developing and refining research projects and ideas useful for both librarians and other information professionals. It can both present and review research as a journal, and it can simulate dialogue on emerging research agendas and ideas'.

Like the *Electronic Journal on Virtual Culture, LIBRES* is associated with Kent State University, and has Diane Kovacs as Editor-in-Chief. *LIBRES* (standing for 'Library and Information Science Research') is published monthly. Submissions are acknowledged within 24 hours and reviews are completed within 45 days. Keywords searches are possible from NCSU Library gopher's 'Library without walls'.

MC Journal has as its sub-title *The Journal of Academic Media Librarianship*, and may, rather confusingly, be referred to under either heading. The first issue appeared in 1993, and the journal provides abstracts of articles on media librarianship (with instructions on how to access the full text). It is intended to be published at irregular intervals; the editor is Lori J. Widzinski at the State University of New York at Buffalo.

Finally, the *Public-Access Computer Systems Review (PACS Review)* is concerned with end-user computer systems in libraries. The aim of the journal is to publish papers on topics such as, 'campus-wide information systems, CD-ROM LANs, document delivery systems, electronic publishing, expert systems, hypermedia and multimedia systems, locally-mounted databases, microcomputer labs, network-based information resources and online catalogs'. Like *LIBRES, PACS Review* is associated with a computer conference – in this case, the moderated *PACS-L* list. Users of the list also automatically receive the journal.

PACS Review has Charles Bailey, Jr., at the University of Houston Libraries as Editor-in-Chief, and is published on an irregular basis. It includes peer-reviewed articles, news and comments, and reviews of books, network resources and software. The first two volumes have been published in book form by the American Library Association's Library and Information Technology Association, and a full index of all volumes is available online.

Electronic newsletters and abstracting journals

Some of the main electronic publications of interest to librarians and information specialists under this heading are collected by Eric Morgan at North Carolina State University, and can be accessed and searched via the use of ftp, WAIS and gopher technologies. Along with *PACS Review*, complete coverage (including back issues) of the following titles is offered: *ALA WON* (the ALA Washington Office Newsline); *ALCTS Network News*; **Citations for Serial Literature*; **Current Cites*; **IR-List Digest*; *Network News*; *Newsletter on Serial Pricing Issues*; *PACS News*. Of these, the three marked with an asterisk contain abstracts, whilst the remainder are newsletters. The sort of material covered in the latter can be illustrated by describing three of them briefly.

ALCTS is an abbreviation for the Association for Library Collections and Technical Services, a division of the American Library Association. Its *Network News* appears at irregular intervals, and is concerned primarily with the Association's activities, especially with conferences and other programmes.

The *Newsletter on Serials Pricing Issues* is produced by Marcia Tuttle through the Office of Information Technology at the University of North Carolina. Its aim is clearly indicated by its title, and it is proving to be a useful venue for interchange of opinion between librarians, publishers and subscription agents.

Network News includes recommended reading for librarians, use of gophers, special collections available on Internet and a range of news items. It is edited by Dana Noonan at the University of Houston.

New titles are continually appearing. For example, the first issue of *LC Cataloguing Newsline* appeared early in 1993. It is intended to report on activities at the Library of Congress that may be of interest to the library community. It will also be used to obtain feedback from that community. The newsletter is planned as a quarterly and is edited by Robert Hiatt at the Library of Congress. Other electronic newsletters that may be relevant are: *CC News*, *Health Info-Com Newsletter*, *ACQNET* (the Acquisitions Librarian's Electronic Network), *Consortium Update (SPIRES)*, *Information Networking News*, *Meck Journal* and *Metrobriefs*.

Current Cites provides a good example of an online abstracting journal. It currently scans the contents of over thirty printed journals in the library and information area, looking for articles on the following topics – optical disc technologies; computer networks and networking; information transfer; expert systems and artificial intelligence; hypermedia and multimedia; electronic publishing: Apart from the bibliographical citation, brief, but useful comments are provided on each entry. The editor is David Robinson of the University of California at Berkeley, and the monthly issues also appear in print in *Computers in Libraries*. One additional online abstracting journal that might be of interest is *Hot off the Tree (HOTT)*, which abstracts articles dealing with information technology. It is, however, becoming urgent that electronic journals should be covered by ISI citation databases and the traditional bibliographical guides to the field (such as *LISA*).

Electronic conferences, etc.

The easiest way of gaining information on these, and on how to access them, is to use either the 'Library-Oriented Lists and Electronic Serials' by Charles W. Bailey, Jr, mentioned previously, or to access the 'Directory of Scholarly Electronic Conferences' provided (and regularly revised) by Diane Kovacs and colleagues at Kent State University. The latter directory notes well over a hundred computer-mediated conferences of interest to library and information specialists. The entries cover an extensive range of topics, though with particular emphasis on subject specialisms, library activities and training. For example, in terms of subjects, GEONET is aimed at geoscience librarians and information specialists; MEDLIB is intended for staff in medical and health science libraries; SHARP is devoted to the history of the printed word. In terms of examples of library activities, COLLDV is directed primarily at librarians involved in collection development, whilst INDEX is an indexer's discussion group, and LIBREF provides for communication between reference librarians. JESSE is an example of a useful discussion group for information and library teaching – curricula, educational methodologies, computing in teaching, etc.

PACS-L has already been mentioned as an important computer conference for academic and research libraries. Its concern is particularly with the use of information technology, (OPACs, CD-ROMs, etc.) in such libraries. It also acts as the means for distributing *Current Cites*, *PACS Review* and *PACS News*.

NETTRAIN, as its name implies, encourages discussion of training in the use of networks. More specifically, it is intended as an electronic forum for Internet/BITNET network trainers. Besides allowing the exchange of information, advice and resources, it is also concerned with a wider-ranging discussion of training in the use of Internet world-wide. Both these lists can be searched interactively. For this, telnet to 'a.cni.org' and log in as 'brsuser'.

Two other useful lists can be accessed via the North Carolina State University Library Gopher. One is *VPIEJ-L*, which is a discussion group for electronic publishing; the other is *CWIS-L*, which is concerned with campus-wide information systems. Entry via the 'Library without walls' allows these lists to be searched interactively.

Arachnet and BBS-L are two wide-ranging lists of interests. Finally, *BI-L* is a useful list for librarians who wish to discuss topics relating to bibliographic instruction. Like the other lists mentioned above, *BI-L* is a moderated list, so its contents are relevant and controlled. Archives of the various lists can be searched by getting instructions from Eric Thomas' *Infodatabase* available on any mailing list.

Other activities tend to be either less regulated, or less directed towards library and information specialists. A good source of entry is *USENET News*, which collects together bulletin boards/discussion groups/news groups. In the UK, they are best sampled initially via BUBL. An example is *soc.libraries.talk*, which is a USENET newsgroup with much current information of interest to the library community. BUBL also produces a twice-monthly update on what is happening to bulletin boards available on Internet or USENET, and this can be scanned to see whether anything of interest to librarians and information specialists is on offer. BUBL's 'Current contents' are reproduced on the University of Michigan gopher for easy access in North America. Some gophers (Infoslug is an example) have an entry for bulletin boards. Most of these prove on inspection to concentrate on local concerns, but some may be worth an inspection. Telnet sessions to various bulletin boards are possible via *Launchpad* at North Carolina.

Along with these now established (if easily confused) forms of electronic communication, new activities are continually appearing. Two may be of particular relevance to library and information specialists. The first is the growing willingness of commercial journal publishers to list electronically the contents of the titles they publish. For example, Meckler has put up contents listings for the information technology journals (mostly connected with libraries) that it publishes. It has also started listing the book titles that it produces in this field. The second development is the provision of exhibition catalogues online. The outstanding example here is the information on exhibitions at the Library of Congress. Excerpts from these, including some of the illustrations, have been made available online, along with a facility for asking questions about the contents.

Conclusion

The obvious point to make about the present survey is that it results from several weeks investigation of Internet, spread over the past few months. Despite the amount of effort now going into the provision of online guides, carrying out a reasonably comprehensive search in a given field is still a time-consuming activity. At the moment, most of these sources are American, but current developments elsewhere, particularly in Western Europe, suggest much more widespread provision in the near future. This will add its own complications (e.g. multilingual sources) as well as an increase in the amount of online material available.

Whilst doing this survey, it was possible to compare online sources for library and information workers with those made available to other specialists. Our impression is that the former are generally following best current practice in terms of the content control. For example, all the electronic journals in the library and information field have effective systems of peer review. Most of the problems facing electronic serials are, in fact, ones with which library and information workers have long been familiar – identifying, accessing, searching, quality control and archiving. This suggests that the library and information community might well take its own electronic serials as an exemplar in learning how such publications are best handled nationally and internationally. After all, library and information specialists will increasingly be called on by specialists in other disciplines to provide advice on electronic serials; so they might as well obtain their initial training by handling subject matter they understand.

Such training, whether in library schools or elsewhere, will obviously employ some of the online resources described here, but additional material suitable for such training is already becoming available. A good example is the hypertext presentation on electronic journals prepared by Raleigh C. Muns at the University of Missouri. This was developed to explain what electronic journals are (it contains over 175 sample issues), where to locate such journals, and how to retrieve them. The presentation and how to access it has been described on the list *VPIEJ-L* mentioned above. Discussion of how these electronic sources should be used for teaching is also under way. Presumably, library schools will go ahead with their own individual plans for implementing teaching of electronic serials. It is to be hoped that the material will also be shared via the online serials that have been discussed here.

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Status of librarians in Ghanian universities

I K Antwi
The Library, University for Development Studies, Tamale, Ghana.

Abstract

The paper gives brief background information on the evolution of university education in Ghana since 1948. It then attempts to explain the concept of status and the parameters of academic librarianship. The main objective of this paper was to find out the current status of librarians in Ghanian universities. To achieve this, data were gathered from the three older university libraries in the country through a questionnaire. It was found out that there was no consensus on the status of universities in Ghana. It then gives several suggestions to improve on the academic status of librarians in Ghana.

Introduction

Ghana has five functioning universities. These are the University of Ghana, Legon; University of Science and Technology, Kumasi; University of Cape Coast; University for Development Studies, Tamale; and the University College of Education, Winneba respectively. The oldest and largest is the University of Ghana which was established in 1948 as the University of the Gold Coast and prepared students for the degrees of the University of London. The University of the Gold Coast became autonomous on October 1, 1961 and was renamed University of Ghana. Currently the University of Ghana has five faculties, four schools and eight institutes.

In 1951 it became obvious that one University College could not cater for the higher education needs of the Gold Coast (now Ghana). Consequently, by a Government Ordinance of October 6, 1951, the Kumasi College of Arts, Science and Technology was established. The College was more or less the type of institution envisaged by the Elliot Commission on Higher Education in West Africa[1]. Courses were offered initially in teacher training and Arts subjects up to the Higher School Certificate Level and in Engineering, Pharmacy and Commercial subjects. As the College expanded it was made to concentrate only in science and technology. Following the report of the University Commission[2] which was set up in 1961 the College was upgraded to a fully-fledged University – Kwame Nkrumah University of Science and Technology – by an Act of Parliament on August 22, 1961. The name of the University was later changed to the University of Science and Technology in 1966. The University now has eight faculties and six institutes.

The University of Cape Coast started as the University College of Cape Coast in 1962, and was placed under the supervision of the University of Ghana. With this arrangement students of the College were examined in courses approved by the University of Ghana and the degrees, diplomas and certificates were awarded by the latter. The institution was renamed the University College of Science Teachers in 1964. It attained full University status in November 1971 and became known as the University of Cape Coast. The University presently has five faculties, on School and three institutes. The main aim of the University is to produce graduate teachers in Arts and Science subjects for the second cycle institutions in Ghana.

The University for Development Studies was established by law on March 2, 1992. It will, however, admit its pioneer students in October, 1993. The university will offer courses in agricultural sciences, medical and health sciences, integrated development studies, social sciences and environmental and cultural studies. The University College of Education took off in November 1992 with the main objective of being 'an additional university for the training of graduate teachers for our senior secondary schools, training colleges, polytechnics and technical institutes to supplement the output of the University of Cape Coast'[3]. These two institutions are new and as such this study did not include any information about their librarians.

Polytechnics and the Advanced Teacher Training Colleges in Ghana are also in the process of being upgraded to degree awarding institutions. These institutions, to be effective, should have well-equipped libraries to be managed by competent librarians. The status of librarians in these institutions will largely be influenced by that enjoyed by librarians in the older universities in the country.

Status and academic librarianship

According to Ranganathan 'status of anybody is taken and not given by somebody else. So it is with the library personnel. Again, taking the status by ourselves is not a simple affair. It requires the effort of establishing the usefulness of the profession to society. This really boils down to every member of the profession putting out his best service to society'[4]. The status of librarians in universities will be high or low depending largely on the efforts and contributions of librarians towards the realization of the corporate goals of the university. The university administration will not readily accord academic status to librarians unless the latter are in a position to make a strong case for it.

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In the view of Holley academic librarianship encompasses a variety of roles such as 'faculty engaged in teaching and research; as helping professionals with clients to serve; or as managers with a business to run[5]'. Onwubiko[6] has also written at length on the nature of academic librarianship. According to him, the academic librarian performs bibliographic functions such as collection development and rendering assistance to users and also engages in active research and publications, seminars and conferences. He also performs some teaching functions which can be in the form of formal classroom teaching or the library's user education programme. Academic librarianship also involves the following: preparation of teaching aids, such as reading lists and guides; preparation of visual aids; individual conferences with advanced students on their problems with their papers and theses.

Kurshid and Russell[7] have reviewed the academic status of librarians and information scientists. They hold the view that equating the salaries of librarians with that of the faculty does not solve the problem. Neither does the granting of comparable faculty ranks. Academic status should also extend to such areas as membership on academic committees, tenure, intellectual freedom, retirement, vacation and research leave.

Methodology

Data for this study were obtained through a questionnaire. One set of the questionnaire was mailed to each of the three older university libraries in Ghana in September 1990. These were duly completed by all the University Librarians to give a response rate of one hundred per cent.

The questionnaire was designed to solicit responses on the modalities of evaluating librarians, financial support for research, involvement of librarians in university administration, benefits enjoyed by librarians and suggestions to improve on the academic status of librarians.

Data were then manually extracted from the questionnaire and analysed to form a basis of discussion in the following paragraphs.

Position of the university librarian

The laws which established universities in Ghana duly accord recognition to the position of the University Librarian. He is a principal officer of the University and a member of the Senate. But none of the University Librarians in Ghana has even been allocated on official car even though the respective Registrars and Finance Officers do enjoy this facility.

Position of other librarians

The University of Science and Technology reported that its librarians enjoy academic status. The situation at the University of Cape Coast and the University of Ghana is, however, different. In the case of the University of Cape Coast it is only the Librarian and his deputy who have academic status. The rest are considered non-academic. The University of Ghana Librarian indicated that his university is now in the process of redefining the status of librarians.

Since data were gathered for this study in 1990 there have been two further developments on the status of librarians in the University of Ghana. The librarians, when requested by the university administration, opted for academic status and this was endorsed by the latter. We cannot, however, divorce academic status from higher qualifications and research. With this in view the university administration at Legon made a regulation to the effect that its librarians, with their new status as academics, should possess research degrees at least up to the masters level. In addition librarians' promotion would be based on their bibliographic expertise and research through publications in scholarly journals. It then became clear to the librarians that they had underestimated the implications of their decision to prefer academic status.

In 1992 the librarians resubmitted a fresh memorandum to the university administration preferring 'professional status' rather than academic status. In their reckoning the professional status will facilitate their promotion since this will not be based on research and publications. It is a great pity that the librarians at Legon have not shown consistency in their desire to acquire a suitable status within the university environment. It was therefore no wonder that the university administration rejected their so-called professional status and insisted that their earlier request or academic status should stand.

From the foregoing we can infer that in Ghana there is no consensus yet on what status best befits librarians in the university system. The situation in Ghana is similar to that of Nigeria as reported by Awaritefe[8] and Akhidime[9]. For instance, in the University of Lagos, all librarians are considered as academic staff by the administration but the local branch of the Academic Staff Union of Universities stipulates that only sub-librarians and others of higher rank may be members. In the case of the University of Ibadan, the academic status of librarians is based on an assumption. For example, a librarian can vote at Senate but cannot be voted for.

Evaluation of librarians

Once the status of librarians is clearly defined it should be able to designate on the Boards or Committees in the university to evaluate librarians. The Registry Review Committee assesses librarians in the University of Ghana, Legon. We have already been told that the status of librarians in the University of Ghana was yet to be defined. With the above Committee responsible for evaluating librarians in Legon we could infer that the university administration would have liked to confer administrative status on librarians.

The Committees that assess lecturers in the University of Science and Technology and the University of Cape Coast also assess librarians. In all the three universities the evaluation of librarians is based both on their bibliographic expertise and their contribution to knowledge through publication. The University of Science and Technology requires an Assistant Librarian to have at least three articles published in reputable journals before he could be considered for promotion to the Senior Assistant Librarian grade (which is equivalent to Senior Lecturer). His counterpart in the University of Ghana Library required at least two such publications which possible took into consideration the fact that he did not then enjoy academic status. The University of Cape Coast Library also insists on publications as a condition for promotion even though it did not give the minimum number of publications required. None of the libraries gave the number of publications required to move beyond the Senior Assistant Librarian cadre.

Support for research

All the three university libraries reported that librarians qualify to get financial aid to undertake research. This is to assist librarians collect data to publish so as to facilitate their promotions when due.

Librarians at the University of Ghana and the University of Cape Coast, unlike their counterparts in the University of Science and Technology, do not enjoy research leave. Research leave facility in universities is intended to assist academic staff to concentrate on their individual research projects and publish the results of their work. Once librarians are required to publish, as a condition for promotion, they should be entitled to research leave also.

While all librarians in the University of Science and Technology enjoy sabbatical leave their counterparts in the University of Ghana do not. In the case of Cape Coast University it is only the Librarian who enjoys sabbatical leave. Sabbatical leave is one of the avenues of staff development. It also enables staff to undertake research and contribute to the advancement of knowledge. It is therefore anomalous to deny the bulk of librarians in Ghanian universities such an important facility.

Librarians in the universities in Ghana are entitled to study leave with pay similar to that of lecturers. This enables them to obtain additional qualifications or update their professional knowledge. It in turn equips them to perform their duties more efficiently and effectively.

Librarians, unlike lecturers, do not get the yearly book allowance of $100 per head. Book allowance is given to the academic staff to acquire relevant publications so that they can cope with their teaching and research. Librarians also need to update their knowledge and should benefit from this allowance which has eluded them for almost a decade.

Participation in university administration

As has already been pointed out, only the University Librarians are members of Senate. Professors, Associate Professors and Heads of Academic Departments are automatic members of Senate. A Deputy Librarian is equivalent to an Associate Professor and as such should also qualify to be a member of Senate.

Librarians are members of Convocation. Convocation periodically elects some of its members to Senate. It is gratifying to note that a number of librarians have over the years been elected to Senate on the ticket of Convocation. Convocation also elects some of its members to serve on the University Council. This means that any interested librarian can contest to become a councillor in his own right.

Librarians take part in the governance of the halls of residence for students in the various campuses. Some of the librarians have variously been appointed as Hall Wardens or Senior Tutors while a majority of them have served as tutors. This has afforded the librarians the opportunity to interact with the students outside the library environment.

Departments in the library

The establishment in the university libraries in Ghana makes provision for only one Deputy Librarian. A library in a university may be compared with a faculty. The latter has several departments with senior academics heading them.

The two major divisions in the Library, Readers Services and Technical Services, should be headed by Deputy Librarians. This will create avenues of promotion for deserving Senior Assistant Librarians which will also enhance the effectiveness of library services.

All the University Librarians receive responsibility allowances. It is only the Deputy Librarian at the University of Ghana who receives responsibility allowance. It would be a morale booster if all the Heads of department, in addition to the Deputy Librarians, get responsibility allowance.

The position of Dean in universities is elective and for a fixed term. If the Library is considered as a faculty then one may be tempted to suggest that the University Librarian should also be elected and serve a fixed term. Two of the respondents intimated that the present practice of appointing University Librarians to retiring age should continue. The third respondent suggested that University Librarians should be elected to serve five years unlike Deans who serve three years only.

Conclusion

There is yet to be a consensus on the status of librarians in the Ghanaian university system.

Alemna has also confirmed that librarians in academic libraries in Ghana do not know their proper status. He added 'When it suits the university authorities (for example, in salary grading) they are placed together with the academic staff. In other situations like the granting of sabbatical leave, librarians are considered as administrative staff'.[10] Rao[11] has also found out that a similar situation pertains in India where some college librarians are even regarded as clerical staff.

The bibliographic functions of the library facilitate teaching and research work in the university. Academic status for librarians is thus a recognition of the fact that academic work cannot be effective without libraries. Librarians should not take academic status for granted or as a right. They should earn it through their individual and corporate contributions to the realization of the goals of the institution. Much depends on the University Librarian. The recognition the head of the library gets from the university administration will depend on such factors as his expertise, intelligence and competence and this will positively or negatively affect the library and hence the status of the other librarians in the system. Much has been written on the exemplary qualities of John Harris, the pioneer University Librarian of the University of Ibadan[12]. He is regarded as the doyen of academic librarianship in Nigeria and rose to the enviable position of Acting Vice-Chancellor both at the universities of Ibadan and Benin.

We cannot divorce academic qualifications from the status of librarians. The faculty generally holds the view that the qualifications of librarians are much lower than their teaching counterparts. In some universities the possession of a Ph.D degree is one of the prerequisites for promotion to professorship. Many university administrations are therefore not predisposed to giving academic status to librarians because the bulk of them do not possess doctorate degrees. The universities in Ghana now insist that prospective librarians should possess a minimum of a bachelor's degree and postgraduate qualification in librarianship. As reported elsewhere in this paper librarians in the university system in Ghana also enjoy study leave. They should therefore make use of the study leave facility to acquire advanced qualifications to enhance their status.

University librarians should take a keen interest in research. They should disseminate their research results through seminars and publications. The university libraries in Ghana should therefore reactivate their seminar series to afford staff the opportunity to share their experiences and knowledge with colleagues. In addition to this librarians should make use of the inter-faculty lecture series in the universities to present papers. In this way, they will go a long way to convince the academic community that, apart from their traditional bibliographic functions, they are also capable of undertaking research and disseminating their findings through seminars and publications.

In addition to these the Committee of University Librarians should institute an Annual Lecture Series. This will provide a forum for librarians to share their experiences and promote the effective acquisition, dissemination and utilization of information in the universities. The users, especially the lecturers, should be involved in these lectures as resource persons and participants. In this way the latter are likely to have a much more positive view of university librarians as worthy of academic status.

In 1990 it was reported by Alemna[14] that collection development in university libraries in Ghana was anything but satisfactory. He found out that the collections were outdated and money to procure relevant publications was inadequate. By 1992 the collections had not improved. For example, the Balme Library of the University of Ghana was allocated only 2.0 per cent[15] of the university's recurrent budget as against the recommended 5.0 per cent[16]. It was therefore not surprising that this library could only purchase 35 titles[17] of books during the period under review.

It is clear that university libraries in Ghana lack the required institutional support. University libraries are *sine qua non* to effective teaching, studying and scholarship and as such they should be well-funded and supported. The bibliographic functions of the university library are basically academic in nature. The universities in Ghana should therefore take practical steps to recognize librarians as academics.

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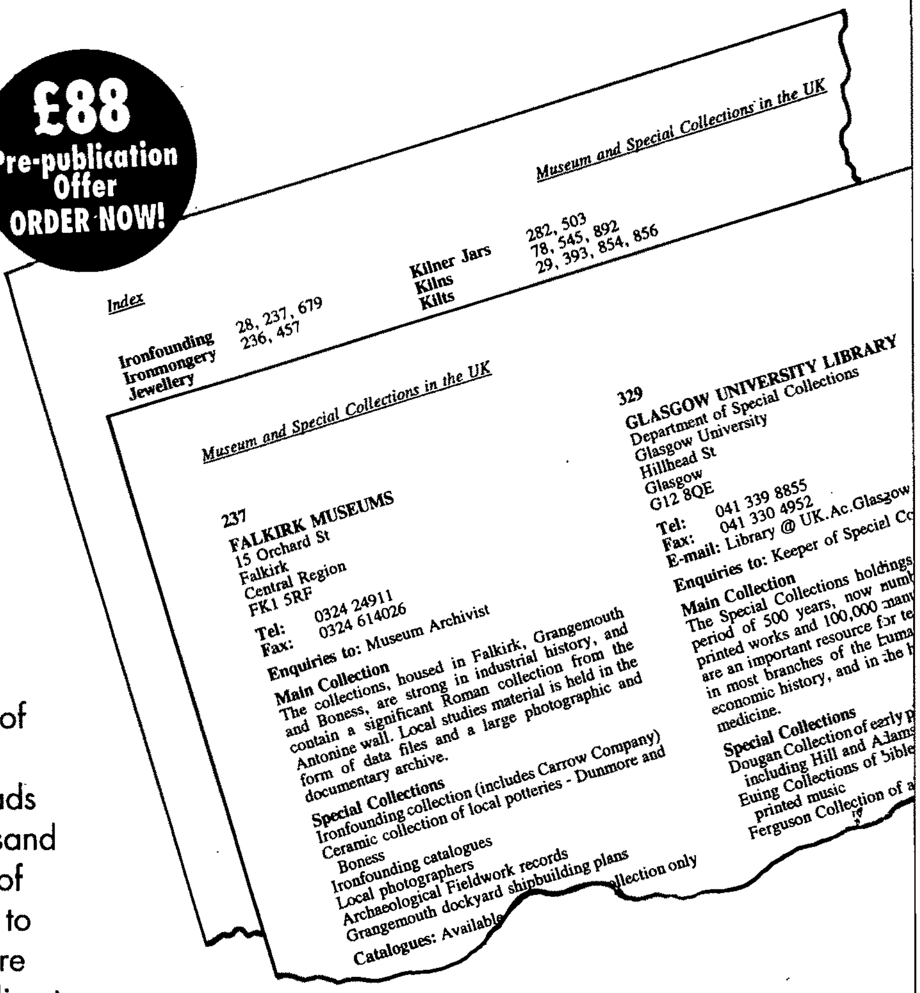

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Selection criteria for technical options available in electronic publishing – networks, CD-ROM and micro-products

John H Ashford
Ashford Associates Ltd. 72 Harrow Lane, Maidenhead, SL6 7PA

Paper presented at China's Information Policy and Strategy to 2000: an International Information Management Symposium, Beijing, People's Republic of China, 6-11 September 1993. A meeting organized and run by Aslib, The Association for Information Management, to formulate the information policy and strategy to the year 2000, on behalf of ISTIC and sponsored by the British Council, to be presented to the Government of the People's Republic of China.

1. Introduction

The choice of strategy and the evolution of policy for electronic publishing as an aid to information dissemination are at present complicated by the variety of technical options and by uncertainty about the proper balance between relatively high risk innovative and more predictable conservative approaches. This paper is intended to provide a set of 'route maps' through the technical options available now and in the near future, and to indicate the criteria which would guide choice of technology for various application categories and investment priorities. A lucid and accessible guide to the publication and availability of scientific and technical papers will be found in Line, 1992[1]; this paper has been followed in several places below, but Line's discussion of the impact of new technology on publishers is not repeated.

There is no intention here to be either exhaustive or prescriptive, if only because the rate of change in technology and in user expectations is too great to draw over-assertive conclusions. What should emerge is a methodology for displaying and grouping technical options in relation to the various aspects of user requirement. Most references are drawn from text and text-based publications in the fields of science, technology and medicine (STM). Financial and economic data services are noted only briefly, not from lack of interest, but because the users are a highly specialised community and the rules which guide its choice of communications channels are dominated by fast response and currency of data in a way which is uncharacteristic of STM sources.

There is, however, one aspect which is always to be treated with caution, and which is not easy for economic analysts. This is where an infrastructure investment made for one purpose turns out to be highly productive for another. A historical instance was the development of rail freight networks in England in the mid-nineteenth century, which rapidly enabled not only passenger traffic, but also the development of a rapid and low cost postal service. Only in May 1993 did the UK Post Office finally give up the sorting of mail in transit on overnight trains between major cities. Similar effects are likely in information dissemination arising from the availability of general purpose public or private telephone and data networks, and predominantly entertainment-based cable and satellite communications. The determination of prices for shared information services is likely to be no less complex, no less political than that of shared utility infrastructures in the recent past[2,3].

2. Information formats

The format of information, that is, whether it is expressed in narrative text, tables, vector graphics, raster images or analogue surfaces affects the ease with which it may be transferred and applied in electronic systems. Languages which employ non-roman, and especially character scripts raise added complexities, not because they are inherently more awkward than roman scripts – and ASCII representation – but because the accident of development of so much computing and communications software in an American English environment has introduced unbalanced expectations of what may readily be achieved.

Bibliographic text

This was the predominant form of information stored on the major 'database vendor' sources such as MEDLINE and BLAISE in the early days of on-line searching. These entries are typically short, highly structured, and generally confined to standard roman scripts. A small number of bibliographic sources – including some national bibliographies – carry records in other scripts including those with all European diacritic marks, Greek, Cyrillic and, in specialised cases, Chinese, Japanese and Korean. Other scripts are still exceptional.

A feature of searches on bibliographic databases is the use of record structure to narrow the scope of queries. For example, rather than look for 'Gilchrist' and 'thesaurus', the searcher is likely to specify 'Gilchrist' as author with 'thesaurus' in title. The results of searches are commonly lists of ten to fifty bibliographic records, amounting in the last case to no more than 50,000 characters of data – a relatively short file for transmission.

Bibliographic records – and catalogue entries as a subset – are now held on all scales from several million on major national bibliographies to a few hundred in personal collections on PCs.

Full text

Full text materials in computer manageable format developed later than the bibliographic sources. There are at present two main categories of interest in information services, full texts of formal 'publications', and electronic mail messages and their complementary bulletin boards.

These texts are again mainly in roman founts, though non-roman causes no intrinsic difficulties, but they are often loosely structured and may have only a minimum of formal text for source and destination. A retrieval from a full text database may range from a single page, maybe up to 3,000 characters to be delivered, to the ten or twelve pages of a journal article, maybe 40,000 characters. Many of the less technical and non-mathematical papers distributed to known interest groups as electronic journals or seen as candidates for on demand publishing[1] fall into this category.

If the document is in the sort of 'presentation' format set out by a word processor or desk top publishing system, then the raw text is accompanied by the same sort of control framework (or 'mark-up') as applies to text with graphics, and so is treated within that category. Structures defined within SGML (ISO 8879 / 6868) or RTF (Microsoft® Rich Text Format) use only a standard set of ASCII characters, and, at least in principle, minimise problems of interpretation because vendor-independent decoders are available for many work-stations.

Text with graphics

Occasionally in bibliographic records, much more commonly in full text sources, graphic material is used as a framework for presentation of texts or is embedded in the text as part of the information content. If the graphic part is coded in some vector representation, then the data volume per page is usually not much different from the same area of simple text. Problems arise with the diversity of codes currently in use to represent the proprietary mark-up of various commercial word processors, and the similar range of ways of representing vector graphics. For example, Microsoft WORD on the Macintosh IICX on which this article is being composed offers conversion to and from the following graphic formats – MacPaint (a Mac local bitmap format); PICT and PICT2 (vector formats common to several drawing packages); EPS (Encapsulated Postscript – a quasi-standard page description format including vector graphics); and TIFF (a widely used bitmap format used by page scanners). It does not deal with GKS (Graphical Kernel System for engineering drawings) or any of the more recent CAD (Computer Aided Design) or GIS (Geographic Information System) exchange formats. Other information scientists will find quite different selections available on the equipment and software on their desks.

The less technical and mathematical papers distributed to close interest groups as electronic journals fall into this category. Chemical data structures are a major special category, and have a wide literature dealing with their application in research and development information sources, and with applications in patent searching[4,5].

Images

For material which is not in computer readable form, for photographs, for maps and complex drawings, and for 'artistic' texts such as manuscript Chinese, image representation in the form of bitmaps is a useful format. Several exchange formats are widely available, notably TIFF (for scanned images from PCs), and the CCITT Group 3 and Group 4 Facsimile standards. These are versatile, and not particularly sensitive to the source material, except for special cases like geological maps (complex colour and needs high resolution) and spectral plots (scanning can lose the critical peaks).

There are three main shortcomings. The data in bitmap (or raster) image format is difficult to manipulate for its content. As a rule only clipping, stretching and rotation of parts of an image are straightforward. Extraction of narrative text from a scanned image by OCR (Optical Character Recognition) may prove anything from excellent to useless depending on the application. The second problem is with volumes. A page of DIN A4 covered in text may run to 3,000 bytes (characters) of storage space. The same page, scanned to a bitmap and compressed, will take 25,000 to 50,000 bytes as a black-and-white image, and several times more in colour. If search results are to be transmitted over networks, this becomes a significant matter in computing network loads. Finally, if fine detail is to be represented, special scanning, display and printing equipment may be required, and at raster densities above 400 points per inch (160 points per cm.) this becomes expensive.

3. Network technologies

This is a complex subject, beyond detailed comment here. See [6] for detail.

Local area networks (LAN) are now widely established technology for communications over an area of up to one kilometre radius or thereabouts. It is reasonable to expect that groups of five to twenty workstations on a single network, and many more on linked networks can communicate with each other, with file servers and with gateways to wide areas, at effective channel capacities in the region of 10 MHz, or 1 million bytes per second shared over the active work stations. Note, however, that network performance may degrade sharply as the load approaches saturation, and that theoretical capacities are based on reasonably even loadings with messages of modest length – assumptions which may not recognise the irregular loads which result from images held in the text traffic. It is commonly reported that Chinese and roman scripts take up the same bandwidth for the same real information content.

Wide area network costs are difficult to deal with, not least because several countries have, as a matter of policy, provided wide area network capacity to academic institutions at no direct charge to the user –

JANET in UK is an example. Other users generally expect to pay the local PTT connexion charges to a node on an X25 network, and packet charges thereafter.

4. High density media

An important alternative to the use of communications networks for the delivery of information in electronic formats is provided by high density digital media such as optical (or magneto-optic) discs, digital tape and – potentially – by high capacity solid state devices such as 'smart cards'. From a wide range of theoretical options, three are most promising in practice, namely CD-ROM discs, Digital Audio Tapes (DAT), and large (30 cm or thereabouts) WORM discs (Write Once Read Many). The main applications for WORM discs appear to be in 'in-house' document and archive storage – for example, contract document archives[7] – and apart from some specialised projects[8] they are not particularly significant for information dissemination. A general review of digital mass storage options will be found in reference [9].

CD-ROM

CD-ROM (Compact Disc Read Only Memory) looks like an ordinary 12 cm. audio compact disc, but stores (currently) up to 650 Mb (million characters) of digital information. There are derivatives CD-ROM XA and CD-I concerned mainly with non-text formats. The relevant standards are ISO 10149 for the physical format; ISO 9660 for data storage volume and file structure. Until recently, all CD-ROM discs were made by producing a master disc from a magnetic tape file, followed by 'printing' impressions on product discs as for audio CDs. In the last year, compatible devices for small volume writing of CD-ROMs, one-by-one, have become available at comparatively low cost – less than US $20,000 for a small production centre – with a cost of CD blanks of just under US $30. The break-even between 'mastered' and 'write-your-own' is probably in the region of 50-100 copies per production cycle. CD-ROM readers, especially for PCs, are now falling in cost to less than US $1,000 for a good quality single spindle unit.

Libraries and information centres have rapidly adjusted to CD-ROM sources for major bibliographic files such as CDMARC Bibliographic from Library of Congress (4.7 million records on eight discs for US $1,315 per year) and nearly 2,000 smaller files of all sorts. Networking of CD-ROM readers on LANs in information centres is becoming established[10]. The National Academic Union Catalogue (Katalog Induk Perguruan Tinggi) in Indonesia has opted for CD-ROM as its main medium for catalogue distribution to fifty universities[11].

A CD-ROM disc will usually store 400 million characters of raw text plus detailed indexes and formatting; or the equivalent in images – about 10-12,000 pages. Access is 'at random' but noticeably slower than a PC hard disc. A recent announcement from a UK disc producer claims, however, a doubling of storage density, and compression algorithms capable of storing up to two-and-one-quarter hours of colour digital video on a disc[12], so these limits may soon be challenged. CDs are durable, resistant to dirt and damp, and easily stolen.

One interesting CD image application is the ADONIS service[13]. In this product, high quality images of pages of journals on biomedical subjects are held on each CD-ROM and subscribers are licensed to make prints on paper for use in their institutions. A typical weekly issue of ADONIS will contain as many as 10,000 page images representing articles from current issues of 430 journals covered. Indexes are delivered on the CD-ROM, and accumulate on the user's PC hard disc. Index content is based on Excerpta Medica, and access points are author, title words, journal name, ISSN, year, volume, issue and pagination.

DAT Tapes

A high density medium which has yet to yield its technical potential for large scale document image transfer is the Digital Audio Tape, or DAT. This medium offers storage of 1.3 Gb per tape, and fits into a drive which will alternate with the standard 3.5 inch floppy disc on a PC or LAN server. Access is sequential, and averages around 20 seconds to a designated record, but if material is intended to be downloaded to magnetic disc this is not a problem. It is a cheap form of storage – about US $0.015 per Mb – and has so far been used mainly as a backup medium for LAN servers.

DAT appears to be a suitable medium for ADONIS-like image distribution, or for the word processor text+ graphics of a journal. Some 20-30,000 articles in this format could be stored on DAT as a compact, on-demand publishing source. It is less robust than CD-ROM, but even easier to put in a pocket or handbag.

5. Micro-products

There are many small scale information products – directories, product catalogues, tourist guides to major cities (Glasgow, Chicago), standards (IMC guidelines for small consultancy practices compliant with ISO 900x / BS 5750), training modules for young police constables, and more. These information products are typically distributed on one or more floppy discs, and held on a microcomputer or LAN with suitable access software for searching on their contents.

Passive sources

The majority of micro-products are passive, that is, the end-user searches and interprets the data provided, but does not affect the content, or vary the search paths or strategy. Database access (including SQL), free text searching and hypertext access are all available.

Interactive technologies

In a minority of cases, the user may alter the content of the micro-product data set, may add local data, or may bias or reset the access paths. Such approaches tend to be very product specific, and so far are mainly found in tutorial and self-teaching systems. The proponents of neural networks[14] and rule-based[15] retrievers argue that future improvements in effective performance for end users will follow these paths, but this is not yet established.

6. User interfaces

User interfaces fall, for present purposes into three categories, simple, manipulative and supportive. An invaluable review of user interfaces will be found in reference [16] together with references and an extensive bibliography.

Simple interfaces range from the 'glass teletype' – maybe now rare – through page-mode on terminals or PCs, to graphic user interfaces (GUIs) such as Microsoft Windows, X-Windows and the Macintosh convention. In simple mode, these do no more than allow the user a window of some form on the database, through which indexes may be examined, queries submitted and data viewed. A manipulative interface, usually PC based, adds the facility to acquire information retrieved, change it to suit the user's requirement, and add it to local resources by, for instance, word processing.

Supportive interfaces provide aids to the user in formulating searches, interacting with the user to improve relevance or recall performance, and ordering search results in a helpful manner. There are many experimental and demonstration systems[16, 17], but so far relatively few commercial products outside the large online bibliographic networks. However, this is an area of active investment by vendors, and those text retrieval products which do offer such interfaces – for example STATUS/IQ, TOPIC and Professional Librarian – will soon be joined by others.

A special case is the provision of assistance to users in the fast and accurate keying of Chinese characters. We are aware of much academic and commercial research and development in this field, but not so far of any consensus on the best approaches.

7. The route map

In this section the ways in which users' functional requirements and the products and services described above are related are set out in a graphic format. In the first four figures, the vertical axis represents the range from small to large scale databases. This is related to data complexity, volatility, user needs at the interface, and the type of user community addressed. (The products cited in figure 3 are a fairly arbitrary selection for purposes of illustration, out of the many in use.) In figure 5, a view of the interaction between investment cost and complexity is shown, followed in figure 6 by the parallel relationship between availability of development resources, the technical ambitiousness of the projects, and the associated level of development risk.

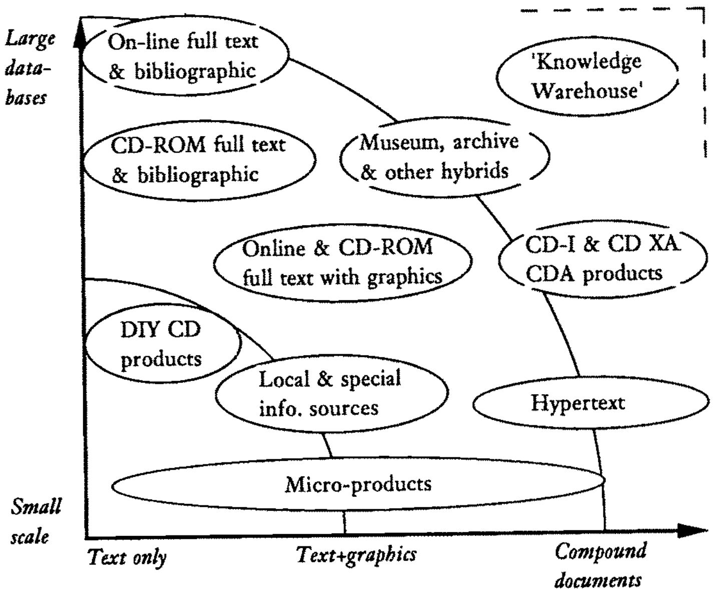
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Figure 1. Database size vs. complexity of data

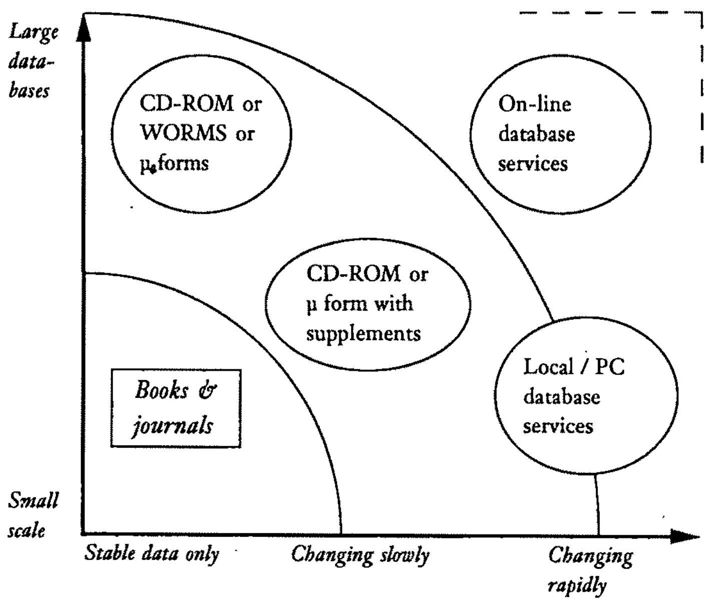
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Figure 2. Database size vs. volatility of data

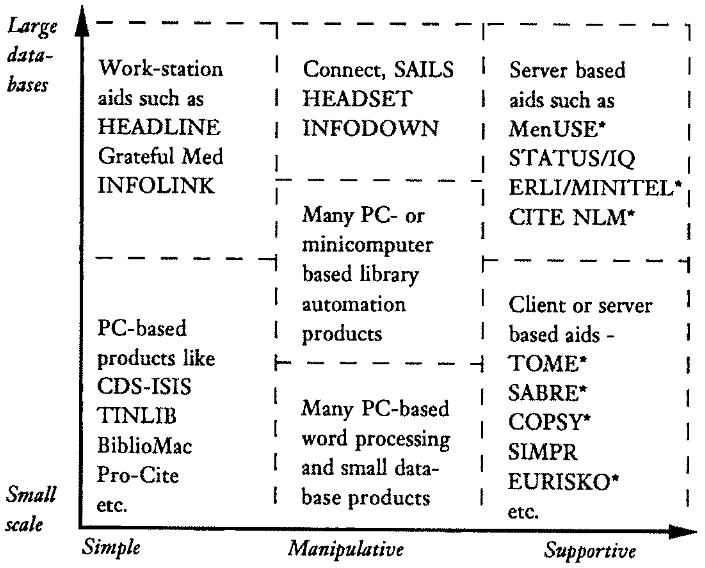
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Figure 3. Database size vs. user interface – see[16] *for detailed discussion of products marked *; others briefly in*[18]

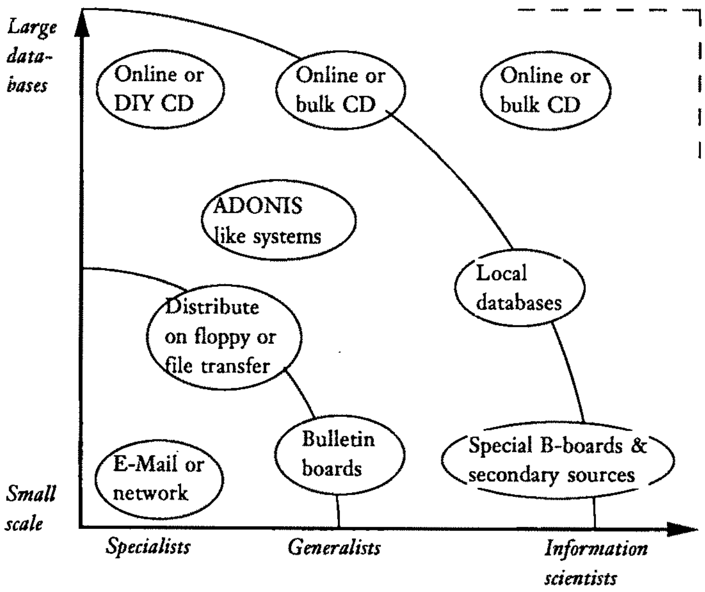

Figure 4. Database size vs. users' needs

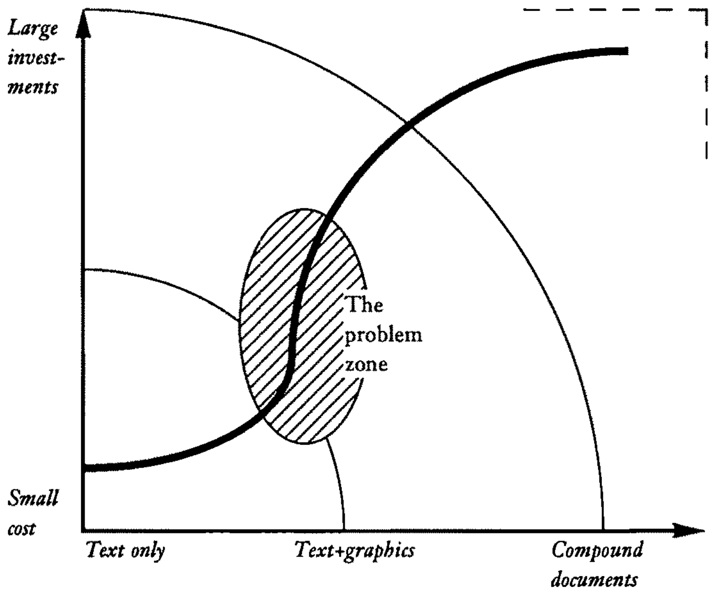

Figure 5. Investment vs. complexity of data

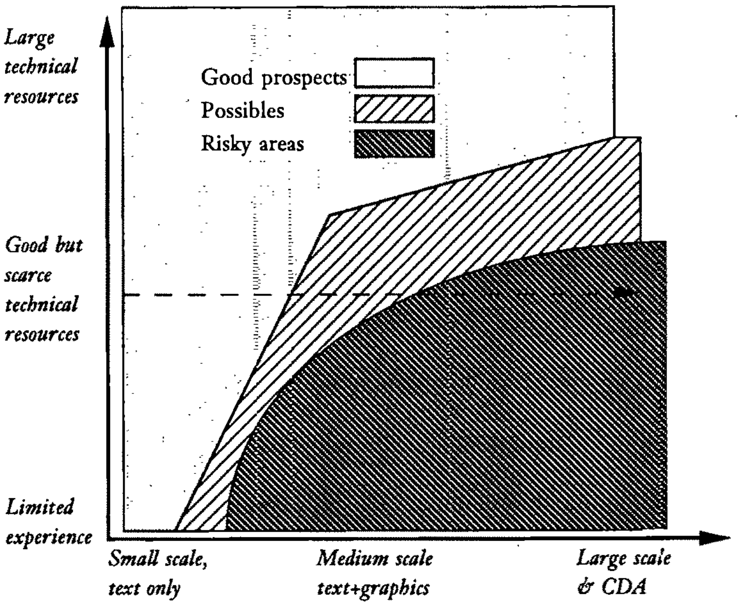

Figure 6. Risk factors vs. complexity of systems

8. Acknowledgements

Anyone who writes on this subject is likely to be indebted both to Maurice Line and to Brian Vickery who have, over some years, published valuable papers. In addition, I am sure that Sally Banks, John Gurnsey, Robert Tsui and Elspeth Scott would recognise topics we have discussed, and to which they have contributed. The responsibility for what I have done with the ideas is, however, wholly mine, and none of my colleagues is in any way responsible for any errors which may be found in this paper.

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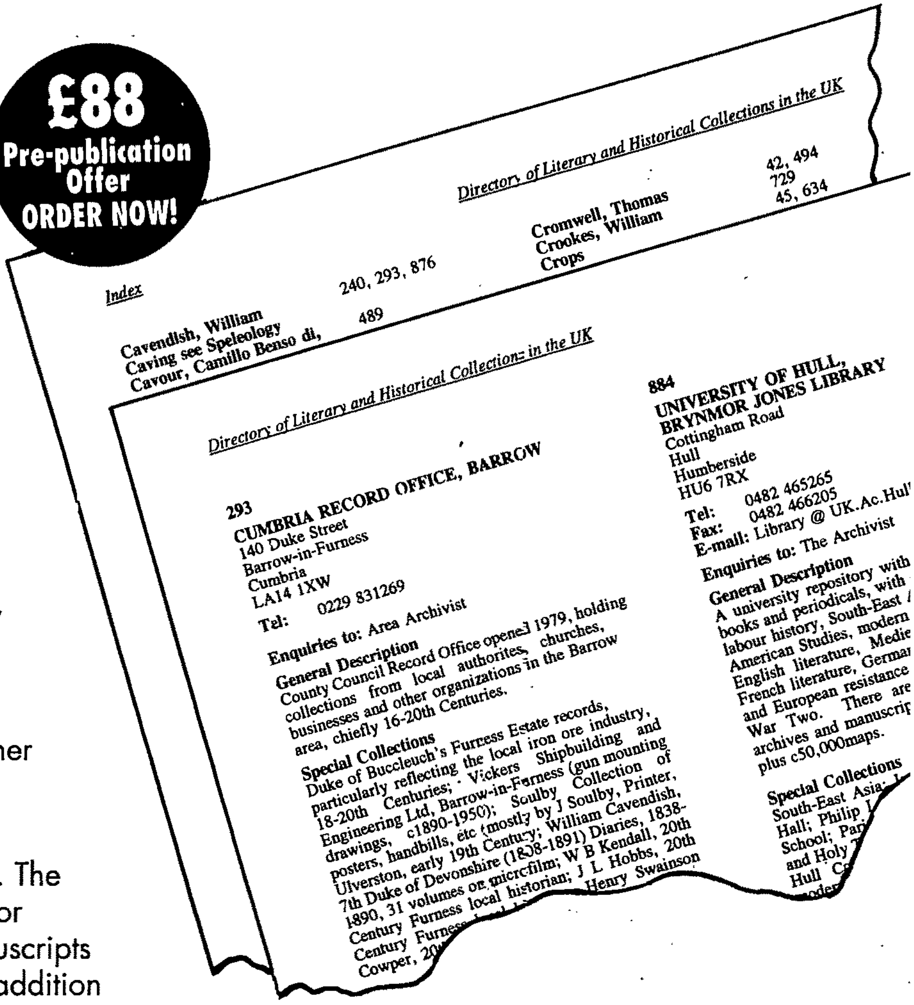

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Full, co-operative, and profitable use of China's information resources – foundations for a policy

Elizabeth Orna
Orna Stevens Associates

Paper presented at China's Information Policy and Strategy to 2000: an International Information Management Symposium, Beijing, People's Republic of China, 6-11 September 1993. A meeting organized and run by Aslib, The Association for Information Management, to formulate the information policy and strategy to the year 2000, on behalf of ISTIC and sponsored by the British Council, to be presented to the Government of the People's Republic of China.

Introduction

First, I wish to express my appreciation to The State Science and Technology Commission, and The Institute of Scientific and Technical Information for the opportunity to contribute to this very worthwhile endeavour.

The orientation of what I have to say will be practical, and based on experience – my own as a practitioner, and that of current and recent researchers in relevant fields. My own concern has for many years been with how information is used at the level of the organization, and with what we can learn from that in developing policies at all levels up to the national.

In this talk, I shall:

- Propose definitions of information and information resources that I have found the most useful in my work.
- Offer some foundations for successful policies for the use of information – again on the basis of practical experience.
- Draw attention to some recent findings on what makes for success and failure in innovation, which parallel the observations on successful use of information.
- Suggest some points that may make a focus for our discussions, and propose some top-level objectives for a policy and some possible first steps towards developing and implementing it.

Before I begin, let me tell you the assumption I have made about the objective of the project on which we are engaged; I am assuming that it is:

- To develop a **practical** policy for the use of information, which is oriented towards **action and application**, and based on a **realistic understanding** of the current situation.

If we take that definition of information as the food of knowledge we need, then we can see that **information resources** consist of:

- The actual stocks of visible information that are available to feed the knowledge that people need
- The knowledge that individuals and groups of people have which has the potential for being transformed into information to feed the knowledge of others
- The resources of human skill and technology which can help us in communicating information, and in turning information into knowledge, and knowledge into information.

A policy for using information resources then depends on knowing:

- What resources are available
- Who needs to use them to achieve their objectives

and on using human and technological resources to bring people together with the knowledge they need.

Three lessons about information

In the course of quite a long life spent in trying to do useful things with information, I have learned three lessons:

1 Information has value **only when people have transformed it into knowledge and applied it;** outputs not inputs are the true measure of value.
2 We have to be aware of the **full range** of information we need in order to succeed in our aims; for example the businesses that succeed in innovation are those which take pains to understand the market and their customers, as well as to acquire scientific and technical information.
3 It is very difficult to co-operate in using information. Even when we seek to communicate information to others, it often doesn't reach them; if it does reach them, it is often not understood and therefore not acted on. If we want to make sure of co-operation over information, the people concerned have to spend a lot of time negotiating and building trust with each other.

Ten foundations for success in using information and building information policies

When I was writing the book *Practical information policies,* (Orna, 1990), I made case studies of a number of organizations and businesses. At the end, I tried to see what features were common to organizations that were successful in their management of information. I came up with a list which, I was encouraged to find, matched the results of projects carried out by researchers in Europe, the United States, Australia and Japan.

Organizations that succeed in developing policies for using information to support them in achieving their key objectives:

1 Have a clear definition of their objectives, and a shared interpretation of what the objectives mean.
2 Use their objectives to:
    - Define the knowledge base which they need to achieve them, and the information resources they need to support the knowledge base

  - Create an information strategy that supports the achievement of their objectives.

3 Invest in human resources for adding value to information, encourage and value the 'know-how' of workers, give training to develop flexible skills, and encourage initiatives by groups from different functions.

4 Invest in information technology on the basis of their understanding of what they need to do with information, and use technology to support their workers in using their knowledge and skills.

5 Monitor the environment in which they operate to keep their knowledge base nourished, combining information from outside with inside information; and communicate the results horizontally, as well as up and down.

6 Keep their knowledge base up to date by interaction with researchers, other businesses in the same field, suppliers, investors, and customers.

7 Establish and apply appropriate measures to monitor and evaluate:
  - The way they use information and the results they get from using it
  - What it costs them to acquire and use information, and the benefits they get from it.

8 Recognize that different groups of people have different interests in information, and promote negotiation to accommodate them.

9 Limit the risks of introducing changes in the way they manage information by taking changes step by step, and by using each phase as a means of organizational learning.

10 Show commitment and readiness to learn at all levels, starting from the top.

A key purpose to which information must contribute in China is appropriate innovation – in technologies, products, and organizational forms – and its diffusion. Therefore it is valuable to turn now from factors that make for success in developing profitable policies for using information to some recent findings about...

What makes for success in innovation*

When I am considering a topic, I find it encouraging when the conclusions that I have reached in the light of my own discipline, are supported by the conclusions of people from a different discipline. This is certainly the case in the question of what makes for success in information strategy and what makes for success in innovation. You will see the parallels in these key points which are emphasized in the studies of innovation:

1 R&D investment is a necessary but not a sufficient condition for successful innovation. Successful innovative firms keep a close eye on the market, and on demographic and social change; and they spend a lot of time listening to their customers.

2 R&D is a 'capital stock of knowledge which can be built up over time but which depreciates' (Bowden & Ricketts, 1992, pp.30-31) – so it needs feeding and maintaining by constant new inputs of information. And the maintenance depends on 'managerial and organizational skills to apply' the inputs of information (Newby, 1993).

3 A well-educated and skilled labour force helps innovation because 'it makes it easier to introduce new technology successfully and to develop techniques by drawing upon workers' informal knowledge and experience' (Bowden & Ricketts, 1992, p.44) and it increases the pool from which new ideas can come. Studies of the effectiveness of vocational education and training in Japan, the USA, West Germany and the UK suggest the need to develop the habit of learning and of acting in a self-reliant way. If the people who work in an organization have this habit, then 'organizational learning' can be effective, and the organization can respond quickly to change.

4 Risk in innovation is minimized by:
  - Being able to draw on internally generated information
  - Close associations between buyers and suppliers
  - Good communications between upstream and downstream operations
  - High trust between the parties involved, including shareholders while the chances of success are reduced by:
  - Concentration on expensive high-technology projects to the exclusion of diffusion-oriented policies which emphasize knowledge, standards and training
  - 'Short-termism' in funding and commitment, and in managerial incentives because 'Innovative activities imply costs today and returns in the future' (Bowden & Ricketts, 1992, p.73).

5 Success in working towards and implementing innovation is supported by:
  - People from different functions working together in teams
  - Good communications inside firms and between them and outside
  - Clear lines of communication and free sharing of information
  - Informal information structures
  - Step by step installation of innovation
  - Commitment by management and workforce
  - Training to help workers achieve their potential
  - Active search for appropriate organizational changes to support technological innovations.

6 Success in competition depends on:
  - Understanding other companies, competitors, collaborators and suppliers
  - Understanding the changing relationships between competitors and collaborators

- Information and good lines of communication between professionals from the same discipline who are employed in different businesses.

7 Competition is not the antithesis of collaboration
  - 'Informal communication, active collaboration and competition provide a motivating atmosphere' (Bowden & Ricketts, 1992, p.172). In the marketplace of the real world, trade is between interdependent firms and can lead to an overall increase in prosperity' (ESRC, 1993).
  - Successful businesses know:
    - Which differences give them a competitive advantage
    - How to limit the ability of their rivals to erode these differences
    - How to limit direct competitive confrontations.
    - 'What one keeps to oneself and what one shares is... the essence of management of competition' (Bowden & Ricketts, 1992, p.220).

8 The most useful government contributions so success in innovation and competition are:
  - Investment in education and training
  - Supporting and complementing the knowledge of individual businesses by collecting, storing and spreading information from a wide range of fields that have a bearing on their activities (see for example, Fransman's account of the Japanese innovation system)
  - Developing an effective network for spreading information between industry and academic research.

It is not possible to transfer other people's solutions in their entirety, because the situation in which they have been developed is different from our own; but we **can** use our knowledge of our own situation to decide how to draw on them in a way that will work for us. It would not be right for me to embark on that; as I said at the beginning that must be for you.

Instead, I shall end by suggesting some broad aims for a policy for full, profitable and co-operative use of China's information resources, and offering some possible focal points for discussion. But your experience and knowledge are what counts in policy decisions.

Aims of policy for full, profitable and co-operative use of information resources

1 To identify the kinds of information which are necessary for developing and supporting a knowledge base that will bring benefit to:
  - The economy
  - The competitive position of manufacturing and service industries
  - The well-being of the people.

2 To identify the groups of people and the institutions who need to co-operate in this.

3 To find organizational forms that promote and support interchange and profitable use of relevant knowledge and know-how.

4 To encourage initiatives at all levels in finding productive ways of using information, knowledge, and know-how.

5 To find a reliable basis for assessing the value of information.

Some suggestions towards policy development

1 Identifying key areas where:
  - The knowledge needs to meet objectives are not understood
  - Adequate information to feed necessary knowledge is not available
  - There are physical and psychological barriers to communicating information which people need
  - Workers lack training to upgrade their knowledge and know-how

2 Concentrating on interfaces:
  - Within and between enterprises, businesses, institutions
  - Between people and technologies for managing information

3 Building on positive existing features which require the bringing together of relevant knowledge for productive use, for example:
  - Horizontal economic alliances
  - Existing links between businesses, suppliers, researchers, and customers
  - Organizational forms like enterprise groups, which bring together different kinds of specialism to benefit from integration.

4 Pilot projects, for example:
  - Encouraging individual enterprises to define their own knowledge needs, and to develop their own information strategy, and learning from the results
  - Helping industry sectors, geographic areas, enterprise groups to develop information strategies.

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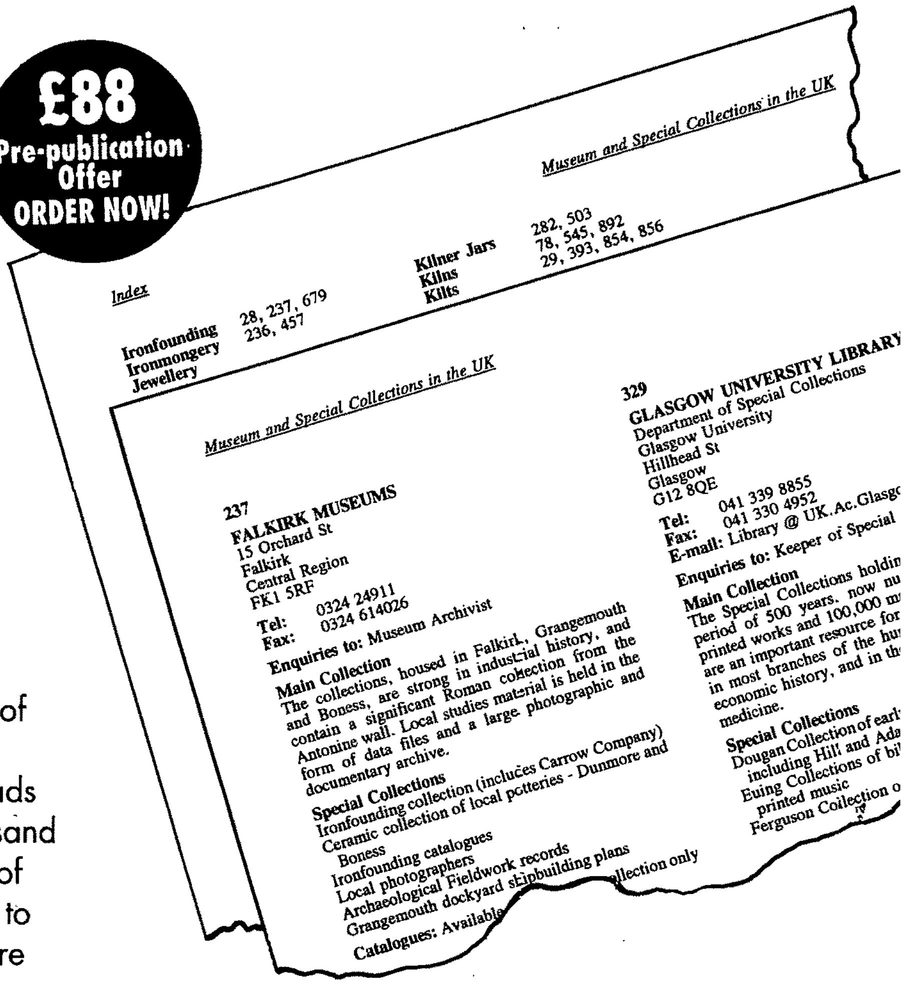

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China's intellectual property rights and scientific and technical information services

Professor Charles Oppenheim
University of Strathclyde

Paper presented at China's Information Policy and Strategy to 2000: an International Information Management Symposium, Beijing, People's Republic of China, 6-11 September 1993. A meeting organized and run by Aslib, The Association for Information Management, to formulate the information policy and strategy to the year 2000, on behalf of ISTIC and sponsored by the British Council, to be presented to the Government of the People's Republic of China.

Introduction

In this talk, I propose to cover two areas of intellectual property. These are **copyright** and **patents.** I will examine both of these topics in regard to the provision of scientific and technical information and the development of a dynamic and growing electronic information industry. For I believe that any country that plans to have a healthy information industry requires strong and rigorously enforced patent laws, and strong and rigorously enforced copyright laws.

I should start off by defining my terms. What exactly do I mean by the terms 'intellectual property', 'copyright' and 'patents'? *Intellectual Property* can be defined either in general terms, or in strict legal terms. In general terms, intellectual property is those things that come about from the use of the human brain, and include ideas, inventions, poems, microcomputers, books, films and so on. In strict legal terms, though, the emphasis is on the word 'property'. In law, property is some object or thing that individuals, corporations or countries own – in other words they can assert some rights to it against some or all other individuals, corporations or states.

So, in legal terms, 'intellectual property' represents the legal rights that may be asserted in respect of some product of the human intellect, and would of course include the right to prevent someone making a copy of the product of the human intellect.

Copyright is just one example of the many forms that intellectual property can take. As its name implies, it involves the right of copying. In most countries, it covers the right to prevent others from copying certain copyright works, including words, pictures, photographs, sculptures, films, television programmes, radio programmes, sound recordings, theatrical works, music and other works of artistic craftsmanship. In general, as with so much intellectual property law, the law does not give the copyright owner the right to do something. Instead, it gives the owner the right to prevent others from doing something. In this case, copyright gives the owner the right to prevent others from copying, selling, performing, broadcasting or adapting the copyright work without express permission.

Although copyright covers very many areas of human intellectual effort, in my talk today I will concentrate on just one aspect, but a very important one – copyright in so-called 'literary works'. These include books, magazines, scientific journals, reports and electronic databases. However, before I talk about copyright in any detail, let me give you my final definition for patents.

Patents are the second form of intellectual property I will be discussing today. Patents are the form of intellectual property designed to protect inventions.

An invention is some device that has use to one or more individuals, corporations or countries. It is difficult to define precisely what an invention is, but most people would recognise one if they came across one. Once again, the patent owner gets a negative right. The owner does not get the right to use the invention. The owner gets the right to prevent others from exploiting the invention. In particular, the owner has the right to prevent others from making, using, selling or importing the invention without express permission.

In both cases – copyright and patents – if someone does go ahead and copy or make something without express permission, the owner of the intellectual property can sue for damages. In extreme cases, the person who infringed the intellectual property right might be sent to prison.

So much for the definitions. Let me now look at each of the concepts, and their implications for information dissemination, in more detail.

Copyright

If one looks at the copyright laws around the world, one can broadly class them into three groups. There are countries that have 'strong copyright laws' – and I will define that term in a few minutes, and that have courts that vigorously enforce those laws. These countries include those of Europe and North America.

There are other countries that have strong copyright laws but whose courts are reluctant to vigorously enforce those laws. Many developing countries fall into this heading. Finally, there are countries without strong copyright laws. These include some developing countries and most countries with laws based on Islamic principles.

Interestingly, it is those countries with strong copyright laws and with courts willing to enforce them that have the strongest information industry and the most intense use of information. Some people would argue that this is a cause and effect relationship – the strong copyright laws have led to the strong information industry. (By 'information industry' I include traditional print publishing as well as the electronic information industry). Others would argue that this is coincidence and that the countries would have had a strong information industry because they happen to be the most developed countries anyway. It is difficult to be sure, as one cannot conduct a scientific experiment with a country. However, I would say it is plausible to conclude that there is some relationship between the strength of copyright laws and the strength of the information industry in any country.

So what do I mean by 'strong copyright law'? I would understand the term to mean that the local copyright law would include the following elements.

- Clear and unambiguous protection for literary works, including books, journal articles, abstracts, electronic databases (as 'compilations', and computer software.
- Adequate enforcement procedures and punishment for infringers.
- A general acceptance for respect for copyright materials.
- Clear procedures for holders of copyright to exercise their rights and resolve disputes through the courts or by arbitration.
- Equal treatment for copyright material produced and owned by locals and that produced or owned by foreigners.
- Membership of the two major international conventions on copyright – the Berne Convention and the Universal Copyright Convention – and adherence to the principles in those Conventions.
- Exemptions from copyright that are not too broad. All countries provide some exemptions from a total copyright monopoly – for example, the lifetime for copyright has a maximum length; and certain limited copying activities for the purposes of research or for private study are usually allowed without having to obtain express permission. The question is, in the local law, how wide are such exemptions?

Copyright and China

So how do China's copyright laws fit in to my definition of 'strong copyright law'? Whilst some copyright laws existed in China before the 1949 Communist revolution, after 1949 the major philosophy was that creative works should be available to all. Also, in Chinese culture the act of copying has long been regarded as an act of admiration and respect. However, due to pressure both from abroad (mainly the USA) and from Chinese creative workers and publishers, China began to consider new laws to protect copyright. A new copyright law was adopted in 1990, with an effective date of June 1991. This 1991 law protected works that had been published in China, but failed to provide adequate protection for works that were first published outside China. For example, the 1991 law gave Chinese academic institutions permission to copy or translate works for personal study, enjoyment, teaching or research purposes. It was estimated that copying of US college textbooks, reference books may have been costing US publishers $1,000,000 each year. Software copying was also widespread in China, with losses in 1988 estimated at an enormous $300,000,000 each year.

Late in 1991, the US Government announced that it would penalize China for failing to protect US patents and copyrights, and threatened to raise the tariffs on goods exported from China into the USA. Such tariffs would have damaged both the US and the Chinese economies. In particular, they would have interfered with China's plan to increase its exports and to be admitted into the discussions on the General Agreement on Tariffs and Trade.

The memorandum of understanding

In January, 1992, a Memorandum of Understanding was reached between China and USA. Within this Memorandum, China agreed to join the Berne Convention and to amend its copyright laws to reduce the exemptions.

In particular, China agreed to extend copyright protection for the first time to foreign owners of software, books, films and sound recordings.

Furthermore, China agreed to protect computer programs as 'literary works', and not to insist on any formalities for this protection. The copyright owner will also be able to restrict renting and lending of their software. Software will automatically be protected for 50 years (the standard term) from issue to the public for the first time. I understand that the software copyright was opposed by your Ministry of Machine Building and Electronics Industry, presumably on the grounds that it would damage Chinese software houses and favour foreign software companies. This is a bit worrying, as I understand that the same Ministry may have the responsibility for overseeing the implementation of the software provisions in China. An earlier software copyright law, passed as recently as October 1991, had significant restrictions on the lifetime of software copyright, on the need for registration to get copyright protection, broad exemptions to allow copying for research and teaching purposes and so on.

The software issue is particularly important as most foreign software used in China comprises unauthorised copies. It is not clear to me how China proposes to deal with the many copies of foreign owned software currently circulating in China. The matter is relevant, because unless this issue is tackled vigorously, you will find that database producers will be reluctant to sell their databases online or in floppy disc form to China. They may, however, be willing to sell China databases on CD-ROM, as it is much harder to make copies of CD-ROM than online or floppy disc databases.

China has now joined the Berne Convention, and has stated that where the Berne Convention is inconsistent with local law, then the Berne Convention rules will apply. In practice, though, many problems will remain.

Firstly, it is not clear how quickly individuals and organizations will respond to these regulations. In particular, academic and other institutions that routinely made unauthorised copies will find it difficult to purchase the original documents. In the case of foreign journals and databases, this requires access to hard currency.

Secondly, new policies of your Government have reduced central funding for academic institutions, and require these institutions to earn money as part of the drive towards a market economy. This too will slow down the strict compliance with new copyright regulations.

Thirdly, the regulations that China has promulgated mean in practice there are two sets of copyright laws in China; one for material created by Chinese citizens and much stricter laws applying to materials created by foreigners; this will cause confusion and make it less likely that the new laws will be strictly obeyed. Next, it is still not clear to me that databases, that is, collections of abstracts or full text material, together with indexes and thesauri, all in machine readable form, are explicitly protected under copyright as 'compilations' or as 'literary works'. Next, it is also unclear to me how China will handle the question of translations of foreign materials into local language. In countries with strong copyright laws, you cannot do this without the copyright owner's permission. In China there is a long tradition of doing this without permission. Finally, it has proved extremely difficult in the past for foreigners to exercise their intellectual property rights in China.

Although the costs of obtaining scientific, technical and business information from the USA and elsewhere must appear very high to Chinese academics and research institutes, they are in practice very small compared to the multi-billion dollar levels of international trade that China is promoting. There is no question that access to copyright materials is essential if China is to develop. Copyright materials tell you what is being researched and developed elsewhere. If China is to play the role that it hopes to – of being a major player in international trade – then its citizens must expect to pay the economic price for access to the scientific, technical and business information that it needs.

The role of copyright and information in China's development plans

However, your interest in strong copyright laws should not simply be so that China fulfils its international obligations as a major player in the world's economy. Strong copyright laws will also lead to a growing, healthy, and dynamic local information industry. Locally produced scientific and technical books and journals and local databases can only flourish if they are priced at a level to provide reward for the publishers who undertake the investment in them, and if the Chinese courts show themselves willing and able to attack illegal photocopying of books and journals and illegal copying and downloading of machine readable records. Furthermore, libraries and research institutions must be willing to pay the full price for their information.

Information flow is not just one way. The rest of the world is keen to know what quality research and development is being undertaken in China. There is considerable export potential for your information industries, but they can only thrive in the world market on the base of a secure home market. So for purely selfish reasons – because your information industry has the potential to be a major exporter and earner of hard currency in the years to come – you should be encouraging a strong set of copyright laws at home.

China has quite rightly developed an ambitious policy for scientific and technical information services. Since 1977, you have made great progress in this area. Your Five Year Plans have pointed out that the literature and materials of science and technology should be collected in a planned way, processed and disseminated in order to assist in the development of science and technology in China. Computerized information services have been supported since the 1970s, and you have developed a National Plan for the Applications of Computers. You have had Five Year Plans for the development of Scientific and Technical Information Work. You have a clear nation wide information infrastructure, including scientific and technical information institutes, including of course ISTIC, a wide range of science libraries including the Chinese Academy of Science library, higher education libraries and a network of public libraries. You have encouraged many meetings of experts here in Beijing, including of course this one. You have a National Scientific and Technical Information Policy, which includes commitments to developing a nation wide online scientific and technical information system, setting up a document supply system, developing major collections of scientific and technical information, establishing 250 Chinese databases, to expand the number of Chinese scientific and technical journals, developing information retrieval tools and training large numbers of information workers.

All this is very ambitious. However, I am concerned by your emphasis on scientific and technical information at the expense of business and marketing information. All your reports and publication are about sci/tech information. Your professional society is the China Society for Scientific and Technical Information. In the UK, we have the Institute of Information Scientists and, of course, Aslib, the Association for Information Management. There is no implication in either title that there is an emphasis on scientific and technical information. If China is to compete in the world markets, you also need to know about economic conditions, regultions, and the competitive environment. You will need a greater emphasis on these aspects in the future.

I remain concerned about copyright law as well. The Chinese Government is to be congratulated for its efforts in encouraging respect for copyright. You have issued major laws and regulations which significantly improve the situation. I believe that you can expect a strong export earning Chinese information industry to grow as a result of the changes of laws that you have carried out, *but only if there are changes in attitudes* – which I hope will follow soon.

Patents

I have spoken enough about copyright. Let me finish off with a discussion on patents. I have already defined patents as a monopoly right for inventions. When someone has developed an invention, the inventor applies to a Patent Office for a patent. The patent is a document that fully describes the invention. It is well understood that a strong set of patent laws encourages innovation and technical development in a country. The most important features of a strong patent law are as follows.

- The patent law should provide equal protection for both local organizations and foreign ones.
- There should be clear means by which a patent owner can take an infringer to Court and there should be sever penalties for infringement.
- Patent law should protect all areas of technology without exception.
- Compulsory licenses provisions in the patent law should be very restricted, and should only be rarely used. Frequent use of compulsory license provisions will result in a loss of foreign investment in manufacturing plants.

How does the Chinese patent law fit in to this ideal picture? China issued its first patent law in 1898. The most recent major change was in January 1993. Up until recently, Chinese patent law put restrictions on the ability to patent foods, chemicals and pharmaceutical products. Patents were also only considered to be infringed if someone manufactured the invention, not if someone sold or imported the invention without permission. The Memorandum of Understanding and the new Law have put these aspects onto a more regular footing. Foods, beverages, flavourings, pharmaceuticals and chemicals can now be patented. The maximum life of a Chinese patent has been extended from 15 years to 20 years; since 20 years is the usual term throughout the world, this change is to be welcomed too. The compulsory license provisions, too, have been amended so that they cannot be invoked if the owner of the patent has either made the invention in China, or has imported it into China.

To sum up on patent law: the new Chinese Patent Law is at a level of protection similar to most developed countries. We have yet to see, of course, how willing the Chinese courts are to protect a foreign patent owner if an alleged infringement takes place.

Patent information

A patent is a bargain between the inventor and the state. The inventor gets a monopoly. In return the inventor gets a monopoly. In return the inventor must reveal all that is known about the invention, and the Patent Office publishes the patent document for all to read. It is this information aspect of patents I want to concentrate on.

It is no secret that most librarians and information officers avoid patents if they can. They are not written to the style of a book or a journal article. They are legal documents, written in a peculiar mixture of technical and legal jargon. About one million new patent documents are published each year in the world, and 54% of this output is in the Japanese language alone. It has been estimated that 25,000,000 patent documents exist at the moment. Then again not many libraries stock patents, and those that do rarely have adequate indexes to their collections, or staff who are knowledgeable in patents. Most countries' patents appear in apparently random number order, and it is therefore difficult to be sure if a particular patent has appeared or not, and, if it has appeared, whether the library has lost it or not.

Nonetheless, patents are used a lot, and some database producers have made good profits from the exploitation of patent information – indeed, the most profitable bibliographic database producers are those that cover the patents literature – so their advantages must surely outweigh these disadvantages. In short, people have pressing reasons to use patents.

Advantages of patents as sources

Let us consider, then, the advantages of patents as sources of information. There are four aspects to this. Firstly, there are many patents, so it is a major source; secondly, patents frequently represent the only source of information on a topic; thirdly, they frequently represent the earliest source of information on a topic; and finally they provide more detail.

Let me look at each of these arguments in turn.

Firstly, *there are many patents.* As I already indicated, about one million patent documents appear each year. Not all of these represent new inventions. Precise figures are not available, but a good guess would be that 35% of them represent genuinely new inventions. Therefore, perhaps 350,000 new inventions appear each year. This is similar in size to the number of new articles that appear in the whole of chemistry each year. So, in size, patents represent a sizeable chunk of the scientific and technical literature appearing world-wide.

Whilst on numbers, it may interest you to know that the US Patent Office has a collection of 30,000,000 non US patents for examiners and the public to search; this compares to the total size of *Medline* and *Chemical Abstracts* of 7,000,000 and 12,000,000 respectively.

Of course it could be argued that even if all those patents do appear, they are likely to duplicate articles in the journal literature, so they can be safely ignored. This is a common misconception. The truth is, in the majority of cases, *the patent literature is the only source.* There have been many studies carried out on this subject. These demonstrate consistently that the vast majority of material in the patent literature is never duplicated in the journal literature. The figures vary considerably according to the study, but in most cases the result is that between 70% and 90% of patent documents never get duplicated in the journal literature. So you can assume that of the 350,000 new patents appearing each year, at least 200,000 of them will never see the light of day in any other medium.

So, you can see, if you ignore the patent literature, you are ignoring a potentially vast information resource.

A more subtle argument is that perhaps many patents do not get duplicated in journal articles, but if the invention is important, then it will appear also in journal articles. Not many studies have been done on this topic, and indeed, it is arguable about what exactly is, or is not, 'important', but those which have shown the same pattern as I have just described; even in important cases, the chances are the patent will be your only source.

What about the patents which are duplicated by journal articles? Surely we can at least safely ignore these? No, because usually *patents offer the earliest source of information.*

There are numerous classic cases, including the first description of the punch card, 25 years before the first journal article; the first description of radar, 10 years earlier; the first description of television technology, 5 years earlier; the first description of the catalyst needed to make polythene, 7 years earlier.

Finally, *patents provide more information.* Journal and book editors require brevity and clarity. Patent law requires maximum full description. The inventor must reveal all he knows about the invention. Patents frequently run to hundreds of pages long. They are full of detailed individual examples of the invention. Indeed, it is arguable that their length makes them harder to use, and makes it easier for an inventor to hide the key element amongst much dross, but there is no question, a patent is the place to go for more detailed information. Furthermore, patent specifications frequently contain many technical drawings, far more than a journal editor would be willing to print.

Patent databases

Patents, then, are a crucially important source of information. This is demonstrated by the intensive use of the major patents databases, such as Derwent's *World Patent Index*, and the European Patent Office's *INPADOC* online databases, and by the large sales of the CD-ROM products produced by organizations such as the European Patent Office and Research Publications Inc. All the market research surveys show that patent databases are amongst the most popular of all databases. Patent database producers are amongst the most profitable database producers.

All areas of industry and academia use patents information, not just for scientific and technical information, but also for techno-commercial information. For example, use of patents databases can show you where the technologies are going, who the leading players are, whether those players are changing direction, which countries are the most active in any technology, who the new entrants are, who the most prolific inventors are, and so on. All of this is invaluable for strategic planners, market researchers and others in the business community and in government.

So how should patents information be distributed in China? You already have a well established network of patent documentation centres. These mainly deal with Chinese patents. You have about 70,000 new patent applications a year, quite a small number considering the size of your population and industrial base. However, I think you can expect many more patent applications from abroad in the future, now that your patent law is in line with international standards.

However, your plans for distribution of patents databases have some way to go. Patents themselves do not suffer from copyright problems. Patent laws encourage the copying and distribution of patent documents. However, patents databases such as those produce by Derwent or the European Patent Office should be protected by copyright law, and their distribution will have to be carried out under the terms of licenses agreed with the copyright owners.

Patents information can, and will help Chinese industry develop. No research programme should start without a check of the patent literature. No manufacturing plant should be built without first checking the patent literature. No advance planning of new products or markets should be considered without first checking patent literature. No exporting of any product should be considered without checking the patent situation first.

Patents should be seen as an essential part of every scientist's, engineer's and strategic planner's life. Part of your national plans should therefore concentrate on the purchase of rights to all the major patents databases in electronic form, and on yet further improvements to the rapid and efficient distribution network you have of original patent documents to all who need them. Your plan should encourage the exchange of experiences in using the patent literature and in developing efficient information retrieval services. Finally, your plan should include specific training for your library and information workers in patent law and patent information.

I do not believe there is much chance that you will develop major patent database services for sale into the rest of the world. Organizations such as Derwent and the European Patent Office dominate this market, and it would be difficult to break into that market. However, by encouraging an awareness of patents, providing efficient patent information services to Chinese industry you will ensure that your industry develops and then retains a competitive edge in the markets it chooses to enter.

Conclusions

I hope my talk has demonstrated that two areas of intellectual property – copyright and patents – are

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Raymond A Wall *PhD, FLA, MIInfSc,* is a well-known specialist on copyright. His career has included library work in the public and industrial sectors, and at Loughborough University of Technology. He run courses on copyright and contributes to various journals including *Aslib Information* and the *European Intellectual Property Review*. Apar from his many articles he has edited and contributed to two books. A member of the three principal library and information organizations i the UK, he was the LA Copyright Officer on behalf of all JCC bodies f the Copyright Campaign for five years. An eminent consultant on copyright issues, he is now Aslib's official spokesman on the subject a an Aslib Council Member.

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Aslib, The Association for Information Management
Information House
20-24 Old Street
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EC1V 9AP
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Information policy and strategic development: a framework for the analysis of policy objectives

Professor Nick Moore
Head of the Information Policy Group, The Policy Studies Institute, London

Paper presented at China's Information Policy and Strategy to 2000: an International Information Management Symposium, Beijing, People's Republic of China, 6-11 September 1993. A meeting organized and run by Aslib, The Association for Information Management, to formulate the information policy and strategy to the year 2000, on behalf of ISTIC and sponsored by the British Council, to be presented to the Government of the People's Republic of China.

Abstract
Information will play an important role in the economic, social and political development of the People's Republic of China. The information industries will be of growing importance within the Chinese economy and they will play an important part in the interaction with the international economy. Within Chinese organizations information can be used to improve productivity. Access to information is also an important element in the working of social and political systems. It is necessary to develop a range of policies to ensure that information services and systems are developed in the most effective way. When analysing the policy arena it is possible to identify three different policy levels: industrial; organizational and social. At each of these levels, there are five elements which need to be taken into account: information technology; information markets; information engineering; human resources, and legislation and regulation. By combining the levels and elements it is possible to construct an information policy matrix which can be used to analyse the policy requirements.

Information plays an important role in the economic, social and political development of modern societies. The information and communication technologies that have made such an impact over the last twenty years are technologies that have the potential to transform the ways in which we conduct our affairs.

So far, when trying to understand the implications of this technological revolution, attention has been focused on the technologies themselves. Increasingly, however, it is being recognized that it is information which is the critical resource, rather than the computers and telecommunications systems which are used to manipulate it.

There is a pressing need to develop a framework of policies that will enable us to make full use of information as a national economic, social and political resource. This policy framework will be needed to take account of three trends:

- *The expansion of the information industries.* The creation, production and dissemination of information is already a significant element within the global economy and the importance of the information industries will grow.
- *The growing use of information as a corporate resource.* Information will be used by more and more organizations as a means of increasing productivity, efficiency and effectiveness.
- *The use of information as an element of citizenship.* Information about rights, responsibilities and entitlements will form an increasingly important part of social and political life.

It is worth considering each of these trends in more depth.

The information industries

The information industries are already a significant element within the economies of developed countries. Although the information services sector is still small, it is growing at a faster rate than other sectors of the economy and it seems likely to continue its expansion into the foreseeable future.

These information industries play a vital role in supplying the commercial, scientific and technical information that is required by the other parts of the economic system. They therefore make a direct contribution to overall economic growth.

The Chinese economy is growing rapidly and information services and systems need to develop at a corresponding pace if they are to meet the expanding demand for information.

It is also important to take account of the international dimension. As China becomes more involved in the world economy, so it will be necessary to develop an information sector that can interact with the global information system. At present, however, in most countries there is a net trade deficit in information services – national economies are dependent on the information services provided by the USA and a small number of other information exporters. A strong national information sector is needed to avoid dependence on others.

The information industries can also make a significant contribution to the strength of individual economies within the global market. At present, as we have noted, the international market for information services is dominated by the United States. Yet within each nation state there are very valuable stocks of information which could be traded successfully on international markets.

The Commission of the European Communities has recognized the economic importance of the information sector through the IMPACT programmes which have supported the development of a market for information products and services. Through this programme, the Commission has tried to strengthen the European suppliers of information services.

Information and productivity

Information can be used as a means of improving the productivity and competitiveness of firms. At one level the introduction of technology can greatly improve the efficiency with which clerical and administrative tasks are carried out, thus reducing costs. At another, the efficiency with which equipment and resources are used can be increased by ensuring that production managers are better informed about flows of work, stocks and inventories and the requirements of customers. Further, information about markets and future demands can improve strategic planning and decision-making. Finally, information is an important resource for innovation and product development.

In all of these ways information is being used by successful companies to increase efficiency, to improve productivity and to enhance their competitive edge. In countries like Japan and the USA, the success of many firms can be correlated with their use of information as a corporate resource.

If firms in China are to be competitive on international markets they must take every opportunity to improve productivity. The use of information can make an important contribution to this.

Information is also an important resource in the management of other organizations. Here the task is to ensure that resources are used as efficiently as possible to produce goods and services which effectively meet the objectives of the organization. Information can make an important contribution to internal efficiency, to effective management and to strategic planning. Increasingly public sector managers in Europe are being encouraged to use information as a management resource.

Information in social and political life

The People's Republic of China consists of a complex network of social and political relationships. Individuals have a range of entitlements, rights, responsibilities and duties. They need to be well-informed about these and about the communities in which they live. Without adequate access to information people cannot play their full part as citizens, not can they take advantage of the benefits which citizenship can offer. Without information there cannot be effective participation in social and political life.

The need for this citizenship information is now being recognised within Europe, yet we are a long way from a position where all citizens have adequate access to all the information they need. Indeed a significant proportion of people lack the information-handling skills that are needed to function effectively in our complex world. It is likely that the position is similar in China.

Furthermore, the long-term stability of China depends on the successful operation of social systems and political institutions. These cannot function effectively unless people are well-informed about the issues that affect them; are able to tell the difference between fact and opinion; and are in a position to make judgements based on an understanding of the issues.

An information-intensive world

It is clear that in a number of different ways we are moving towards a position in which information and its use plays an important part in economic, social and political development. It is because of this that it is necessary to develop policies which will contribute to the development of an information-intensive China.

THE POLICY DIMENSIONS

It would be unrealistic to expect to develop a single, unified information policy for China. The policy would have to cover a number of different areas, each of which is subject to the effects of rapid technological change. Any single policy would need to be in a constant state of revision and development.

It is more appropriate to develop a set of information policies, each of which is concerned with a particular aspect of information and its use. To achieve this it is first necessary to specify the areas which need to be covered by the policies.

It is possible to analyse policy needs at three levels:

- Industrial
- Organizational
- Social

It is also possible to identify five elements which are common to each of these levels:

- Information technology
- Information markets
- Information engineering
- Human resources
- Legislation and regulation

By combining the levels and the elements it is possible to create a matrix which can be used to analyse information policy objectives.

THE INFORMATION POLICY MATRIX

	Industrial	Organizational	Social
Information technology			
Information markets			
Information engineering			
Human resources			
Legislation and regulation			

The matrix makes it possible to identify the areas where policy is needed. It also provides a basis for identifying what the nature and scope of that policy might be.

At each of the levels and for each element, it is possible to identify a policy goal. The goals represent the outcomes that might be intended. Having established what the goals are, it becomes possible to identify a range of specific policy objectives which together contribute to the achievement of the overall goal.

Once the policy goals have been defined and the specific policy objectives have been identified, it is possible to consider what activities are needed to achieve the objectives.

It is clear that the matter is complex. Not only is it necessary to consider a number of different dimensions, it is also necessary to take account of the relationships between the different goals and objectives. It is, therefore necessary to take an overall view and the matrix provides a basis for developing this.

It is important to recognize that many of the issues are already covered by existing policies. It is also necessary to allow for the fact that many organizations and official bodies have an interest in information policy.

Industrial policy

Here the policy issues concern the development of an information sector within the overall Chinese economy. The focus is on the development of information industries and on the creation and strengthening of the market for information goods and services.

The policy goal for the People's Republic might be:

> To create within the Chinese economy an information services sector which can make a significant contribution to the economic, social, political and cultural development of the country.

Within this overall goal it is possible to identify a number of specific policy objectives, such as:

- To ensure that information services are available to meet the demand for information that arises from Chinese industry and commerce
- To ensure that information services are available to meet the demand for social and political information within China
- To develop mechanisms that will provide access to global information services, especially scientific, technical and commercial information services
- To develop information services that can meet the international demand for information generated in China
- To ensure that Chinese information industries benefit from global agreements like GATT

Organizational policy

Here the policy issues concern the way in which information can be used as a resource within organizations to increase productivity, efficiency and competitiveness.

The policy goal for China might be:

> To ensure that organizations within China make effective use of information as a resource to improve productivity, to increase efficiency and to enhance their effectiveness and competitive status.

Within this overall goal there are a number of possible policy objectives, such as:

- To encourage the use of information in research and development
- To promote information use among managers
- To develop and implement communication facilities and standards which will assist the transmission of information between organizations
- To increase the productivity of white collar workers through the introduction of information technology.

Social policy

Here attention is focused on individuals and on social groups. There is a general concern about ensuring that individuals receive the information which they need to play their full part as citizens and to receive the benefits that society has to offer them.

The policy goal could be expressed as:

> To ensure that Chinese citizens are well informed about the social, political and economic issues that affect them.

This goal incorporates a number of more specific objectives, which include:

- To develop public information systems and services that are easily accessible by all people
- To ensure that technical or other barriers to communication do not compromise the principle of equality of access to certain information
- To take steps to avoid the development of information-elites
- To develop information networks which meet the needs of social groups
- To define the scope of citizens' rights to be informed and the state's duty to provide information.

Information technology

Information and communication technologies are a vital element in the development of an information-intensive China. Nearly all the policies have a technological dimension. It is necessary to create a communications infrastructure which will allow information to be transmitted both within and outside the People's Republic. It is also necessary to develop policies which will encourage individuals and organizations to exploit the full potential of the technology.

The goal of the policy might be expressed as:

> To ensure that within China, technology is used to deliver the right information to the right users at the right time and at the lowest possible cost.

Within this goal there are a number of possible policy objectives:

- To develop a telecommunications infrastructure which will allow all organizations in China to have easy access to information services and to make use of facilities such as electronic data interchange
- To encourage the use of decision support systems, executive information systems and other information processing systems within organizations
- To develop legislative and regulatory mechanisms which take account of the characteristics of new information technologies.

Information engineering

Information engineering refers to the full range of activities and processes that are designed to improve the management and use of information. They range from the capture and creation of information through its transport and access to questions of presentation and integration. It is highly likely that attention will focus increasingly on information engineering as the infrastructure becomes better established and as information use increases.

The overall aim of the policy might be:

> To ensure that China plays a leading role in research and development in information engineering and in so doing, ensures that the Chinese information system benefits fully from the most up-to-date techniques.

Within this broad aim there are a number of objectives:

- To develop an information engineering capability within China and to encourage the development and application of information engineering within the Chinese information industry
- To promote the exchange of information and experience between Chinese information engineers and, more widely, with their colleagues overseas
- To encourage the take up of information engineering innovations within the information industry
- To promote the exchange of information and experience between the research community and the information industry.

Information markets

The concept of information markets is broader than the commercial buying and selling of information. It refers to all the processes where information is exchanged as a result of the interaction between a demand for information and the supply of it. Thus some demands for information are met through public provision without making a charge at the point of use.

The policy goal could be expressed as:

> To establish efficient market mechanisms that will stimulate the demand for and the supply of information.

Within this there are a number of possible policy objectives, including:

- To develop appropriate pricing strategies to maximize information use
- To understand and exploit the economic characteristics of the market for information services
- To promote internal markets for information within organizations
- To identify the types of information which should be provided free at the point of use
- To ensure that Chinese information services are able to take full advantage of international information markets.

Human resources

Human resource issues represent an important element within the policy framework. Information specialists are needed to develop, produce and distribute information products and services. Workers at all levels also need to be able to handle information as part of their work. This is particularly important for managers. Finally, individuals need information-handling skills to enable them to collect and use information on social and political matters.

The overall policy goal could be:

> To ensure that all people within China have the appropriate skills, abilities and attitudes needed to handle and use information and to take advantage of the opportunities presented by an information-intensive society.

Within this goal there are many possible objectives, including:

- To ensure that there are adequate numbers of trained information specialists to meet the requirements of the Chinese information industries.
- To train managers and others so that they can make effective use of information as an organizational resource
- To ensure that there is a basic level of information literacy throughout China.

Legislation and regulation

There is a pressing need to develop a legislative and regulatory framework within which the exchange and use of information is encouraged while protecting intellectual property and other rights. To do this it is necessary to achieve a balance between rights and responsibilities and to do so in a way which can accommodate the changing requirements of the rapidly developing information and communication technologies. It is essential to develop this framework if Chinese information industries are to play their full part in the global information services system.

The goal of the policy could therefore be expressed as:

> To ensure that China has the appropriate legislative and regulatory framework to encourage the exploitation and use of information while protecting property and individual rights.

Within this goal there are a number of policy objectives such as:

- To provide an internationally acceptable framework of property rights which encourage the development of information industries.

- To ensure that the Chinese information industries receive maximum benefit from agreements like the General Agreement on Tariffs and Trade (GATT)
- To ensure that personal information and data is adequately protected

Developing the analysis of policy

The analysis of information policy which has been presented here represents only the first steps towards the development of a coherent set of policies which can help to shape the development of China as an information-intensive society. From this initial and tentative analysis, however, a number of things are clear.

First, the matter is complex. There are a number of dimensions which need to be considered. Also, the relationships between the dimensions are complex and there are, as a result, many intersections and points of contact between different policy objectives. It is therefore difficult to formulate consistent and coherent policy without being aware of the overall picture.

Secondly, a significant number of issues are already covered by existing policies, programmes and actions. It is therefore necessary to develop information policies which complement and support other initiatives. It is also clear, however, that there are many issues which are not covered by policies. It is therefore necessary to identify and to clarify the issues and from this to formulate policies as they are needed.

Thirdly, the issues involve a large number of different interests. The Chinese government institutions, the provincial governments, the representatives of the information industries, the users of information all have a part to play in identifying what the strategic policy issues are and in formulating appropriate responses. It is therefore necessary to develop mechanisms which will permit the expressions of views and opinions from a wide range of sources.

Finally, it is clear that some of the issues will require a significant amount of research or exploration before it becomes possible to develop policies.

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The Institute of Electrical and Electronics Engineers, Inc.
445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, U.S.A.

Strategic aspects of networking

John H Ashford
Ashford Associates Ltd. 72 Harrow Lane, Maidenhead, SL6 7PA

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1. Introduction

The basic technical components of 'information networking' have been in place since the mid-1970s, when the first generation online bibliographic services such as the INSPEC databases and MEDLINE, implemented on dial-up hosts like Dialog and ESA changed the ways in which librarians approached bibliographic searching – at least in the better funded organizations. The peak of diversification and growth of the online bibliographic database probably came around 1988 when Williams[1] reviewed the near-exponential growth of new services and the extraordinary diversity of the sources which appeared to be viable. At about the same time, however, it was being pointed out that despite the excitement this was generating in libraries, it amounted to less than 15% of the European market in electronic information services, with *data*-oriented financial services dominating the remainder[2]. The share of the host-based *financial* data services has probably subsequently grown – at the time of writing in August 1993, Reuters (a market leader in financial data services) was reported as having difficulty in disposing of its trading profits.

Since 1988, the following trends have become established :

a) The rate of growth of bibliographic online services, both numbers and diversity, has slowed – all logistic growth curves must turn down some day;
b) Electronic data interchange (EDI) and its retail cousin, EPOS (electronic point-of-sale) have become quantitatively important channels for handling business transactions, including, for example, orders and payments for books and journals (ref. 3, pp.448-51);
c) Network vendors (PTTs) have projected major growth in voice, data and graphic communications and have committed themselves to large investments in satellite channels and optic fibre cabling, and to low-cost virtual connexion (X.25) services (ref. 3, pp.411-26 & 432-35; ref. 4, pp.68-9 & 175-82);
d) Academic institutions, often supported by government funding of networks such as JANET, have taken to e-mail, file transfers and bulletin boards as a major new facet of information exchange. This has built on TCP/IP rather than X.25 protocols, and has depended on the development of 'bridges' between different ways of working (ref.[4], pp.429-36);
e) Low cost, reliable local area networks (LANs) have become a normal component of PC-based offices, and have increasingly replaced radial, hard-wired connexion of workstations to minicomputers and mainframes;
f) Electronic publishing on high density media such as CD-ROM has reduced dependence on online bibliographic sources except for the latest and most current references. These CD-ROM sources in their turn used local area networks for multi-user delivery[4].

The effect of all this change has been to open up diverse, reasonably low-cost opportunities for the presentation and distribution of text-based information which are, in effect, subsidized by the investments made on behalf of the business and – especially – financial data services. Information scientists are aware of the challenges – in late 1992, the British Library Research & Development Department listed no fewer than eight out of a total of twenty-two funded studies (36%) as being on topics concerned directly with networking.

2. What are networks for?

Networks are a communications tool. They provide a connexion between two or more users through which information may be searched, transferred or exchanged. There is an implicit requirement that the set of current users may change from time to time, and that any one linkage is particular to the application and to the immediate purposes of the participants. The technology is therefore much concerned at a detailed level with identification of service points and users, switching of resources as required, access control and data protection, recovery from transient faults, and charging for resources used. This can all get somewhat complex [3,4].

If, however, we note that the recent rapid increase in use of all sorts of networks coincided with the development of interfaces which allow the end-user to specify once and then ignore the complexity of communications protocols, then it is possible to take a much simpler view by grouping the *purposes* of the users than the technical resources they use to fulfil them. Four principal cases, with a few sub-categories, may be recognized.

a) *Conversational.* A conversation is an information exchange, often between two, but reasonably among several participants who proceed by alternate question and answer, proposal and comment, assertion and denial – or agreement, until an end-point is determined and the session is closed. Structures are informal but well defined[6], and vary for different communities such as families, research groups, market traders and customers. The content of a conversation is extremely flexible, but often falls into the categories of information seeking, information provision, teaching, command, reporting, or servicing of group relationships. All human societies appear to need conversation, at least at the face-to-face level[7], and scientific research groups exchange information in this way continually – listen during the coffee break in any conference... The vehicle for a conversation may be face-to-face speech or sign language, assisted by watching the expressions of the participants; audible speech by analogue or digital telephone; or, subject to lack of audible and visual cues and of spontaneity, continuous interactive exchange on a network using keyboard or equivalent devices. 'Video conferencing' sets out to replace the loss of visual cues in multi-party telephone calls; large investments are being made by telecommunications suppliers such as BT and AT&T in 'superhighways' to support video conferencing and video telephony (*Computing*, 12 August 1993).

The *purpose* of a network in this case is to facilitate conversation, using normal procedures and structures, at a distance. It saves executives' time and travel costs; but it otherwise does little 'better', and it does nothing intrinsically 'new'.

b) *Transaction processing (TP)*. In principle this could include conversation, as natural language structures can be made to include database, but in practice it is a distinct, and important category. It normally involves a user (or 'client'), who initiates dialogues, a respondent (or 'server'), and a definitive framework within which well-conditioned transactions are processed. Services typically include data validation for format and range; lookup tables to assist in forming messages; and form-structured or query-by-example interfaces to help the user.

This has long been a standard mode of communication for conventional interactive data processing; a typical example from the information world would be transmission of requests for inter-library loans and acknowledgement of scheduling of the materials for despatch.

The *purpose* of a network in this case is to provide processing at a distance, with the validity checking and user assistance which arise naturally from the inclusion of simple frameworks. It saves time and it saves travel costs. In applications where time is critical it may be the only realistic method – consider roadside bank terminals issuing cash; passport checking systems at immigration points; trading in commodities and currencies. Few library or information service (LIS) applications have this critical time element.

c) *Information package transfer* or *active dissemination*. Applications in this group are those where a network user knowingly transmits a complete package of information to one or more known recipients. There is no difficulty in accounting for transmissions, and if necessary charging for access to the contents. The package may range from a simple message such as an agenda for a meeting to the whole content of a research paper. This last category is causing some excitement among journal publishers and academic library networks (8, 9) and may radically alter the way in which learned articles are certified (in place of 'refereed' as now) and disseminated.

Here the *purpose* of a network is to distribute information units to a known set of recipients, at a distance. It saves time, because most of what is involved can clearly be done by post, and has been in the past. There is, however, an arguably 'new' component, in that notes and comments can be added by recipients, and so be exposed to all of the parties to the transmission within a short time, and material received in electronic format can be quickly edited and reformatted using standard word processing or desktop publishing software – with interesting consequences for the maintenance of intellectual property rights.

d) *Electronic publishing* or *passive dissemination*. In contrast with 2(c) above, electronic publishing relies on the users' actual or potential awareness of an information product to request its delivery from a passive source. It has a number of variations, for which the following account is probably not exhaustive – new ideas are appearing regularly.

The information may be 'secondary' or 'indicative' and provide not answers in itself, but pointers as to where answers will be found. The classic network example is the online bibliographic database – AGRIS, CA, ERIC, MEDLINE, National Bibliographies and thousands more. These are being partially superseded, at least for less immediate information, by distribution on CD-ROM, which becomes in turn a candidate for local networking. The information may be 'primary', and so hope to deliver complete answers online. This has always been the case with 'data' services, and is increasing for text-based materials, including newspaper transcripts, drug and toxicological data, standards and regulations, product catalogues etc. CD-ROM is, once more, a partial replacement, saving wide area network costs.

The 'information packages' discussed in section 2(c) above may also be made available on passive databases, indexed through secondary services, or prompted by e-mail to known colleagues. Browsing, rather than prompted down-loading, is more typical of 'bulletin boards', although crude forms of subject indexing are appearing for some of these repositories.

The *purpose* of the network in these cases is often to save time in accessing many sources, and sometimes to save the cost of acquiring many secondary indexes in print form. There do, however, appear to be aspects which are genuinely novel, and would be impracticable without the database and communications infrastructure – notably 'on demand' publishing which delivers only those documents which a user wants, and software distribution, both free of charge ('freeware') and in support of a restricted, licensed, user group.

Like many activities which appear to have been 'invented' by computer scientists or communications services, 'networking' has a large content of providing a service better or faster or more reliably (*better*, hereafter); it shows a lesser contribution to doing it more cheaply (*cheaper*); and there is an even smaller, but sometimes quite crucial set of activities which are practical only within the new technology (*novel*). (For a more detailed analysis in the context of library automation in developing countries see ref.[10]). These classes of benefits appear in all forms of network technology in use, but with different weights, and there is a trend towards novel applications as users come to appreciate the potential of the networks. Some of the more salient effects are noted in the following sections.

3. Local area networks (LAN)

LAN technology has been implemented in many forms, but there is now a strong clustering round two models, distinguished at the physical layer as CSMA/CD (carrier sense, multiple access with collision detection) and Token Ring. The corresponding standards are IEEE 802.3 and IEEE 802.5 respectively. Most IEEE 802.3 implementations are as Ethernet, which is, for most practical purposes, used as a synonym for the physical level protocol. Either approach is cheap and easy to install for modest bandwidths, and there are many sound commercial products.

Standard Ethernet, depending on the physical connexions, offers up to 10 Mbits / sec nominal transfer rate and a basic range of about 500 metres using coaxial cable for the higher bandwidths. This is a widely available and well supported technology, and will migrate progressively to higher bandwidths if required, at some cost. There are several low cost variants, at some loss of performance, and also several proprietary 'fast Ethernet' implementations using optical fibres. While the throughput of an Ethernet LAN is normally higher than that of a Token Ring on similar wiring, its degradation curve at critical loadings is sharp, and traffic limitation may be needed on heavily used networks at peak periods. Multiple LANs are connected by 'bridges' to spread traffic flows.

Token Ring Networks offer speeds up to 4 Mbits / sec, and over similar areas, using balanced twisted pair wiring. Transmission uses Manchester encoding, and at the relatively low transfer rates, degradation curves are flatter than for Ethernet. That is, it runs slower and slower rather than going abruptly into overload. For some years IBM Token Ring was a major product of that large manufacturer, and so it has a large share of the IBM PC-based market. Again there are proprietary products which offer higher bandwidth than the standard provides – at a price. Ethernet and Token Ring systems can be linked via bridges and routers.

Fibre optic links offer an order of magnitude gain in bandwidth for LANs, and easier extension to wider areas – up to two kilometres at present – with a minimum of relay equipment. The American National Standards Institute (ANSI) has defined a *fibre distributed data interface* (FDDI) as a high speed fibre optic networking standard which conforms to OSI (Open Systems Interconnection) and provides a 100 Mbits/sec connexion. This may be used as a high speed backbone for several Ethernet or Token Ring LANs. Commercial products compliant with FDDI are beginning to appear, and the demand for greater bandwidth is expected to speed up the standardization process.

LANs are used in four main ways :

- for shared use of software and file stores in office automation applications, often called LAN Server structures;
- for transaction processing, as an alternative to dedicated connexions to a central service computer (see 2(b) above). This is not usually important in LIS applications, although a number of library automation packages use LAN networks at moderate transaction volumes;
- for active dissemination of files of data, text or graphics (see 2(c) above) including electronic mail; and especially . . .
- for 'electronic publishing' in a local framework (see 2(d) above).

Many accounts of successful LAN-based projects appear to be concerned with some other main information service function, and the LAN is seen as a necessary, but straightforward, infrastructure. For example, the use of LANs for electronic mail; for dissemination of organization messages, standards and directives; and as network servers for standard office automation is widespread, and appears to be both easy to implement and rapidly accepted by most potential users. It is not easy to distinguish, either in print or in conversations with information scientists, between LIS applications showing real benefits, and simple intoxication with new technology. The following are believed to be among the more productive cases.

An example of a fairly complex, heavily-used LAN system in a business library comes from the Midland Bank Group[11]. This library runs services using a LAN infrastructure 'to reduce queues, save wasted staff time, and accommodate larger volumes of data than its PC-based library automation system could deal with' as follows:

- access to catalogue of journals & publications
- (staff) access to library housekeeping
- word-processing and e-mail

- spreadsheet applications
- X.25 gateway to external databases

In this instance the user population and the applications were well defined, and the LAN was an explicit 'new project' to improve performance.

In the case of the design of the museum, local studies and archives database for London Borough of Croydon Central Library[12], the LAN component is almost taken for granted, but is essential to the concept. This system will support a complex relational database of catalogue entries, object descriptions, images and (potentially) full text of documents, and sound recordings. The LAN comes in because the database will be made available, not only in the museum and local history centre, but across much of the library. It will also be open to as many as fifteen concurrent users, some predictable, others not so. The paper cited is all about the system, not the LAN ('...terminals are PCs connected to the SUN by PC-NFS') but the way in which the planning and technical design takes advantage of network availability is characteristic of much advanced library thinking.

Glaxo Group Research Limited has reported applications of LAN technology for e-mail, local report and other information distribution and access to library services and external gateways[13]. It includes also, however, a project critical to pharmaceutical research and development companies, the assembly and editing of regulatory submissions. This can involve many researchers in several locations, and the management of standard formats and definitive versions is demanding.

If this paper had been written in 1992, then the above examples would have been reasonably representative of LAN application priorities for LIS organizations. During the last year, however, there has been a surge of interest in holding CD-ROM sources on local networks, so that they are accessible to many potential users. Software for LAN access to CD-ROM has developed rapidly – packages such as CD-NET and OPTINET for example, and extensions to Ethernet packages like LAN Manager – and many case studies are being reported (see ref. [5], for several).

Two trends are noted. The single CD-ROM drive on a free-standing PC is steadily being replaced by the one-user-at-a-time PC server on a network, and this in turn by the – more difficult – concurrent multi-user access to the server. Secondly, the CD-ROM vendors are coming to terms with this shared use, and many are offering network licence versions, at a price several times that for single user. Quite *how* a library connected through a LAN to a wide area network such as JANET with many academic users is going to prevent a breach of its copyright responsibility to the CD-ROM vendor is not clear, but at least 'intelligent bridge' software at the network gateway from LAN to WAN is likely to be needed.

4. Wide area networks (WAN)

The technology of wide area communications is complex, fascinating, and closely interwoven with political and commercial interests. From the standpoint of the LIS organization, the use of WANs is actually becoming simpler, and in many cases the technical issues of how to connect to which immediate service, and how then to bridge to wider networks can be safely delegated to technical specialists to solve once, and a solution will be available which is then stable for two to three years. This paper is concerned with the strategic aspects of using WAN resources, rather than implementing links, and reference should be made to the literature for accounts of the network technology[3,4] and its use in library networks[9, 14, 15].

It is, however, useful to be aware that there are two main foci for communications projects. Open Systems Interconnection (OSI) is a major standards development, based on ISO co-ordination, to enable the general interconnexion of different communications and computing equipment. It is supported by the PTTs, often depends on CCITT X.25 protocols at the network level, and generally operates on a *connection-oriented* mode, which allows easier monitoring of usage and, where appropriate, billing for services. Most observers believe that in the long run, OSI will absorb the many proprietary subsystems which claim 'open' features, and become the dominant world-wide technology.

Meantime, however, there are probably more actual users (especially in the academic community) of the earlier TCP/IP (Transmission Control Protocol & Internet Protocol) which has its origins in US government and academic network research, and is now the core of Internet. TCP/IP is easy to integrate with UNIX operating systems, works well for academic computing departments and their clients, and, operating in a 'datagram' or *connexionless* mode is easier to administer and more difficult to monitor and charge.

Technical comparisons between OSI and TCP/IP do not easily resolve differences, and the debate will probably run for years. Meantime, practical 'bridges' have been implemented which allow traffic to pass from one protocol to the other and back, in suitably wrapped and labelled electronic parcels, so that Internet is accessible to X.25-based services as necessary.

The applications that depend on WAN connexion and are important to LIS centres have developed in three distinct phases. Until, maybe 1990, dial-up access (IPSS/X.25) to the on-ine bibliographic sources such as ABN, BLAISE, BRS, ESA, DIALOG, OCLC, ORBIT, and RLIN was the predominant application. This lead to subsidiary network traffic for document delivery, such as the facility developed by British Library Document Supply Centre, Boston Spa, for handling electronic requests for loans and photocopies, and networking of the LASER interlibrary loans service – later VISCOUNT, described in ref.15 with numerous other European networks. The rate of growth of the online sector is now limited by the alternative of CD-ROM publishing of bibliographic sources.

The second main phase was that of inter-library communication among (mainly) academic libraries, using academic networks such as ARPANET and

JANET. This coincided with the availability of reasonably easy-to-use OPAC (Online Public Access) facilities for the major library automation package systems[16], and in essence used WAN links to facilitate catalogue search for inter-library loan purposes and sometimes for record acquisition, from a distance. A number of user aid software products for microcomputers were written, of which SALBIN[17] is probably typical. These eased the problems of the end-user confronted with networks like JANET, but offered as their 'product' a non-standard OPAC interface particular to whichever library had been called. The culmination of this phase, or arguably one of the links into the next, has been the publication of the ANSI Z39.50 protocol for a standard format of information retrieval sessions on (predominantly bibliographic) databases. This standard has been incorporated in a number of standard library packages (ATLAS, VTLS for example) and is being used in several cooperative networks for cross-catalogue searching. It has the advantage of concealing the range of OPAC interfaces present in a practical academic network – in Malaysia, for example, the eight major universities and the national library use no fewer than five different packages, and Z39.50 is currently being tried out as one route to improved cooperation in bibliographic access.

Now these earlier stages are being subsumed in what – at least to its more optimistic protagonists – may be a revolutionary expansion of wide area communications. If it is assumed that users may expect – as these advocates propose

- increase in telecommunications network penetration
- rapid increase in effective channel speeds
- large reductions in the real cost of communications
- freedom from political interference
- freedom from commercial restrictions

then a new era of information searching and distribution may be at hand, where those who wish to view a film will dial 'Hollywood' and have it sent over the network; business executives will confer with colleagues and customers in full colour video world-wide, and no longer support airline profits; and librarians and information scientists will become gateway managers to a wealth of freely available information in electronic storage everywhere. For present purposes, and at risk of appearing unfashionably cautious, it is convenient to defer this vision for a few years, and concentrate on what is actually happening in practice, and some of the likely outcomes and problems.

Communications capacity, based on satellite channels and optic fibre networks is certainly increasing. Developments due in the late 1990s, such as B-ISDN (Broadband Integrated Services Digital Network) should incorporate sufficient bandwidth (at least in Europe, North America, and the advanced economies of the Pacific Rim) to serve telephone, telex, circuit switched digital data, television and radio on a common digital system at realistic transmission speeds. Fast packet-switching, based on the evidence that circuits are now highly reliable, and that minimum overheads need be carried by a transmission, will yield improvements of about five-to-one in cost/performance for this mode compared with standard X.25[3]. Cellular radio and infra-red based transmissions for local networks will increase the flexibility with which terminals may be sited and moved around. It is quite difficult to get price projections. The following application developments are likely to be significant for LIS services.

In the OSI-based group, a promising standard is emerging for Search & Retrieve (SR = ISO 10162 & 10163) on generalized structured text databases. It is intended to allow network users to search quite different systems using a common protocol, and expected applications are for catalogue search and record downloading; ILL requests and services; browsing of 'bulletin board' public information sources. SR uses a common abstract model to describe databases, and a generic command format to express queries[14]. Common Command Language (CCL = ISO 8777) is included among the command dialects. This clearly overlaps with Z39.50 in its scope and objectives, and efforts are under way to make the two compatible, even if not quite alike[18]. The promise is that users of 'open systems' through X.25 directly, or by bridging from Internet and others, may search any database of which they are aware, and for which they have access permission, using a single 'language' of access. There are several practical variants, and system vendors do not necessarily conform too closely to all recommendations of the standards.

Still within the OSI domain, *directory services* are of increasing importance. These are based on the closely aligned CCITT X.500 and ISO 9594 standards, and provide a distributed database of *directory service agents.* These agents lead to *directory information trees,* listing information about *objects.* In principle, a user (human at present, but system later) may use X.500 to look up the existence and location of any information object (file, application program, special device) within the network[19]. In practice there are likely to be problems of mapping data sets of such scale and complexity.

In the Internet corner will be found WAIS, WWW and a number of other less widespread network services. WAIS (Wide Area Information Service) runs on a variety of platforms, and is fairly widely available across Internet[20]. It interacts with a user to prepare a well-formed query in quasi-natural language, which is then routed to one or more chosen servers. The server translates the standardized format of the query into its local language, executes the query, and returns a list of 'found' objects together with a computed 'relevance ranking' of the materials found. The user may then ask for delivery of a document, or extend the search to other 'similar' objects. A WAIS *source* is a special document which describes a database and how to contact it, and for a number of servers there are directories of contents. Proponents argue that WAIS is easier to use and more effective than Z39.50, but there is at least anecdotal evidence that the two will converge, and with SR.

WWW (World-Wide Web – otherwise W3 or W^3) is a server within the Internet community which sets out to view all online information in the Internet as a seamless whole. It uses a hypertext-like form of navigation to manage access to 'more basic' information systems such as WAIS and X.500 directories[21]. It assumes 'a world in which all information items have a reference by which they can be retrieved'. There are several public domain versions, for PC, Macintosh and UNIX workstations, and a number of specialized user interfaces for, e.g. legal data. CERN is a main centre of development. Current spread of WWW appears to be mainly limited by the cost or complexity of developing local servers. There is a move towards providing standard server software for smaller computer systems, and also extension of document types to incorporate the needs of commercial electronic publishers.

Within and around WAIS and WWW will be found searching services such as Gopher and Veronica. Gopher is a server originally released at the University of Minnesota, but now widespread in Internet. A first call delivers to the user a 'menu' of search options. Each menu item conceals a network call to another menu, or to a network information service, to a document or to a file. In practice this process seems generally to operate two to four levels deep. Menu items can point to objects anywhere on Internet, and Gopher* burrows in the network, and fetches and carries documents for its user. Given the general academic willingness to share information, Gopher provides a simple, effective access route to a vast range of information deposits. This range of sources is becoming difficult to comprehend, and so indexing servers are appearing – Veronica is one of the latest[22]. Veronica (Very Easy Rodent-Oriented Network Index to Computer Archives, reputedly) provides indexes to Gopher services and is an easy way to locate information without doing a site-by-site search. There are, so far, three Veronica public access servers in North America, and one in Italy. Clearly, at least in principle, it is possible to have such a server which continuously scans all accessible directories of Gopher servers or X.500, and builds a unified index, but in practice the database might become too large and unspecific to be easily understood.

This brief account of current initiatives should demonstrate both the potential and the complexity of these developments. One of the immediate outcomes has been the appearance of a new type of service, which manages information about other information and service providers. The NISS Centre (National Information on Software and Services) based at the University of Bath is one of these[23]. NISS works across JANET X.25 and IP networks, and provides its services mainly to the UK academic community. Standard services include:

- a bulletin board covering computing in higher education
- a collection of databases of information on software and applications
- a number of software and product catalogues
- an electronic publishing service
- a gateway to Internet for JANET users

This service could serve as a model for a number of similar centres for industrial or commercial groupings, to some extend replacing the trade directories and specialist information brokers, although some of the latter will no doubt be among the network-based innovators.

5. Risks & limitations

The potential for the use of networks to access information world-wide is almost self-evident – expertise on wet rice growing from Manila, on wine making from Santiago, on remote sensing from Yogyakarta, on Arabic calligraphy from Seattle, on village fish farming from Madras, on computing theory from Singapore, on mathematics from Leningrad, on education in developing countries from Botswana, on economics from Heidelberg, on forest management from Caracas, on artificial intelligence from Lisbon, on robotics from Nagasaki, or on seismic forecasting from Beijing. 26 million records at the Library of Congress are now available on Internet (24). It is useful, however, to give some attention to the risks and limitations, although some aspects – academic freedom, openness of information access, and monitoring of communications traffic – raise political issues beyond the scope of this paper.

Local area networks are now basic computer technology tools, and should not cause special problems provided the applications are correctly sized and sufficient resources are provided to meet the extra demands of a *successful* implementation. The most popular current application – networking of CD-ROM sources – needs care to acquire the correct licences, and in ensuring that the retrieval software really does provide what it promises, especially in respect of concurrent access.

Wide area networks, for all their promise, are likely to encounter far more problems in practice, and these will arise, not from the underlying technology, but from the nature of the information itself, its organization, indexing and delivery. The most evident problems are of scale and complexity. WAIS and WWW envisage access to thousands of information sources, covering the whole scope of human knowledge. Now cataloguing is costly and fairly difficult, even for books and periodicals, and subject indexing is even more difficult to perform to the satisfaction of large user communities. How, then, can the producers of these electronic stores of information be induced to spend the necessary resources on adding stable and consistent descriptions and subject categories to their files and records, so that the searcher has some hope of retrieving more than a chance selection of relevant material? Content addressing by free text indexing is advanced as one possible solution, but the volumes to be parsed and indexed are daunting, and free text retrieval is notoriously unpredictable when applied outside well-formed texts confined to subject domains understood by the searcher. This is becoming a major concern in academic research groups[24].

A second major problem area is that of the preferred language of the original text. There is an implicit assumption by many software and telecommunications system developers that the world speaks English – or at least, that those who do not work in English do not need to be taken seriously. This position – careless or arrogant – seriously affects the sharing of excellent research work done in countries where the first language is not English. This is illustrated in the first paragraph of this section, where use of the well established sources of expertise cited would ideally involve access in Spanish, Indonesian (Malay), Hindi, Russian, German, Portuguese, Japanese and Chinese as well as English. All of these are major languages of the world, with 120 million or more speakers. Little attention is being given to making wide area networks effective across language hurdles, although it is known that free text retrieval will work for Chinese, if not too well for German.

Chinese language raises some special problems, apart from representation and co-ordination of the traditional and simplified character sets. 'Subject' appears to be difficult to express in a way consistent with Western concepts. For instance, in automation development work with the Urban Council Public Library in Hong Kong, which has a dual Chinese-English collection and catalogue, it became apparent that the new automated collection would have to support both English language subject headings for the English materials, and K C Liao subjects for Chinese. Now K C Liao works well enough for a general collection, but there is probably a need for a more specialized approach to large STM (science, technology and medicine) holdings[25]. How should entry of text and queries by users of limited familiarity with retrieval systems be managed? Will Tsang-Chi keying, which works well for Cantonese and traditional characters, serve also for National Language and simplified characters? If not, what else should be considered – romanized equivalents; five-stroke; three- or four-corner sub-structures; phonetic transcripts; AI supported strokes (Tian-Ma etc.); statistical look-ahead; graphic pad? The issue is not so much whether this can be sorted out and good solutions can be found for information networks within China – this is well advanced – but what can be made of these issues on an international scale.

One partial solution, MenUSE, based on the pragmatic use of simple AI methodology, has had significant success with English/Japanese subject access correlation, and is being tried with European language sets[26]. MenUSE is a tool for building multilingual co-ordinated thesauri. It was originally developed to access MEDLINE, but can now be used for many structured text sources, and has recently been interfaced to the Oracle relational database package. One of the more unexpected results of this work, was that it turned out to be more efficient for a bilingual user to search for Japanese language articles using the English thesaurus, as this side-stepped the slow input of Japanese search terms.

The final problem area to which I wish to draw attention is that of the potential increase in the disparity between developed and developing countries. Wide area networks depend on telecommunications infrastructures at all levels from satellite through microwave and land line to local switchboards and terminal equipment. This is capital intensive, and competes with many other applications for scarce resources. There appears to be a danger that those who already have the infrastructure in place may commit to electronic information storage and retrieval at a pace which will separate the rest of the world from this resource by the sheer magnitude of investment required to keep in touch. At the same time, the present willingness to share, and to keep open access through subsidized networks to information sources in the academic community, is in conflict with the increasing commercial market in financial and trade data, which is 'economically' priced. The publishers of learned journals in STM are unlikely to take the loss of a substantial part of their market coolly, and a swing to commercialization of some parts at least of the distribution of electronic 'academic' documents may be anticipated.

6. Conclusions

Given the present rate of change of so many aspects of telecommunications, any conclusions can only be cautious. However, some matters seem clear :

a Local area networks (LANs) are established technology. The benefits they bring to LIS centres are much the same as for any organization of similar scale – savings in computing resources; improved communications across work groups; removal of redundant information and data entry tasks. For LIS centres there is the particular application of networking of CD-ROM sources to offer shared access to a valuable and expensive external information resource.

b Wide area networks (WANs) concerned with financial, economic and transaction data will continue to dominate the volume tele-communications market, and access to these networks and the data they provide will be at commercial – that is, *what the market will bear* – rates.

c WANs for academic exchanges, databases of 'papers' and catalogues of 'library' holdings will develop rapidly, with X.25, WAIS and WWW as important service windows. The eventual stable state is unpredictable, as the economics of the present networks are in part determined by government subsidy of academic communications, and there are concealed costs in the research and development phases which may emerge with system maturity. The OSI and TCP/IP domains will coexist for some years.

Nevertheless, there are considerable advantages to be gained from immediate participation in a progressive way, provided that investment in long term assets – equipment especially – is controlled at a realistic minimum until the eventual balance of services and costs becomes clear.

d) There are considerable problems of subject access and natural language communication to be resolved before full advantage of networked information services can be taken.

It appears unlikely that information scientists will be short of opportunities and of challenges in the next few years. They will, however, have to respond to new technological demands, and be prepared to re-apply the well established skills of the information specialist in new ways, and in co-operation with computer scientists.

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***Note.* Several papers from this Meckler conference proceedings [ref. 13] have been cited above. Readers should be aware that the standard of the papers presented was somewhat uneven, and that this is reflected in the published proceedings.

*A gopher is a North American burrowing rodent. It is also used as a colloquial term for an assistant – one who will 'go for' things when requested.

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Information service and information product pricing

Lynne J Brindley
Librarian & Director of Information Services, British Library of Political and Economic Science, London School of Economics.

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Introduction

This paper addresses the topic of information service and information product pricing. It aims to combine a discussion of principles with practical examples of pricing in a range of different services, from library revenue earning activities, through online and products, to emerging electronic services. Pricing is considered as part of a market approach to information services which assumes the development of a culture in which information is valued as an economic commodity.

As background to this paper certain contextual assumptions have been made about China and its wish to move to an information economy by the end of the century, to support long-term economic development. The aim is stated as being the creation of a socialist market economy with continuing fast, but sustainable, growth. Currently there is a low level of 'information consciousness' in China, which implies an important and continuing requirement to take initiatives to increase the awareness of the value of information, in order to stimulate an active, and more entrepreneurial information market. This background is crucial to any issues of pricing. In this context information education and skills training will be an important adjunct to support information exploitation, both of a developing internal industry and its products, and also to exploit future connections to the global information market and systems. In China most information is now provided by government information departments, which are beginning to enter the market and offer charged services. Electronic services are beginning to emerge and are forming the beginnings of a database industry (bibliographic, full text, statistics, documents, etc.), with requirements for a CD-ROM production capacity, and networked services to international standards.

It is important to emphasize at the outset that there are critical linkages between the development of wide awareness of the value of information, the gradual emergence of the notion of a market for information, and the more particular questions of pricing. None of these concepts would be considered in isolation. Western experience suggests that often information is more highly valued and appreciated if it is paid for; the willingness to pay is dependent on a culture which understands the value of information resources, and this understanding takes a considerable time to develop. Higher prices will be commanded for more targeted and tailored information products and services, to meet specific user needs.

The following working definitions have been used to guide the scope of the paper. **Information products** are generally discrete packages of information, developed prior to specific needs for them (except perhaps the first), usually with the expectation of providing them to a number of users without modification, ie. they have a more generic purpose than services, eg. CD-ROMs. **Information services** have been taken as the means for storing, accessing, processing, or delivering information to meet the needs of specific users at the time they request service. The overall scope has been taken to include traditional library and information services comprising books, journals, archives, standards, patents, research reports, etc; and electronic products and services comprising CD-ROMs, databases, software, electronic publishing, multimedia, video, etc.

It is important to understand that the latter, ie. electronic information services, are very much dependent on the development of a wider information technology industry and the creation of a communications infrastructure for the country. Telecommunications is the core 'sine qua non' condition of a healthy information industry and the government can play a fundamental enabling role in the planning and development of a pervasive infrastructure.

This paper aims to provide an overview of both pricing principles and approaches, and practical examples of information products and services, mostly UK, European, and USA based. Throughout it will be apparent that different political opinions suggest different balances between commercial and public sector provision, and a 'mixed economy', however balanced, is the prevailing position in major Western countries. A particular inclusion for discussion is the area of government information and the opportunities it may provide for stimulating the information market, including joint ventures. This whole area is important for China as state information accounts for some 80% of sources at this time.

How to create an information service marketplace

No one should think that the area of pricing, particularly of newer forms of information production products and services, is stable or that there are any simple guidelines. Product pricing is fluid, changing and rather uncertain as technology is changing the relative economics of traditional forms of publication against optical media, of use of online databases versus CD-ROMs, and so on. The market is in flux and only a limited number of significant international players are yet making profits from these services.

Initially then, what is tradeable information? The coining of this label in the UK was a deliberate attempt in the early 1980s, through the ITAP Report[1] to create an awareness that information is a commodity which has value; that it can be bought and sold like other commodities; that value can be added to raw information material at various stages; and that, unlike other commodities, information can be sold and retained at the same time. Information can have different values for different types of customers, and can be manipulated by the application of technology for many purposes.

The concept of 'adding value', particularly through IT, is important. Guidelines for UK government departments[2] suggest that this value might be added in any of the following ways and include any of the following characteristics:

- **increased accessibility** (ease and speed), through database access compared with manual searching of information, through fast document delivery, with remote, immediate access;
- **agglomeration,** or an increased value by proximity to other information, eg. an international news database including the *Financial Times, Economist,* and *New York Times,* a 'one stop shop' database approach, where a wide range of topics is accessible within one system;
- **structuring of information,** increasing value by the way information is stored and the complexity of software used to retrieve and manipulate it, eg. patent file searching, chemical structure searching, census data manipulation – each needs to include software capable of manipulating the end result of a search;
- **transaction processing using information,** eg. stocks and shares, travel agent videotext booking system;
- **reutilization of information,** collected for one purpose and being used for another in a different context, eg. vehicle registration, road accident statistics.

The creation of demand for information services needs to go hand-in-hand with ensuring that there are appropriate enterprises to supply such services. North American and European approaches provide for a mix of private enterprise, libraries and government involvement. As a working model, drawing on the work of NCLIS[3], and to stimulate discussion the following roles are outlined which deliberately emphasize the importance of an entrepreneurial sector:

- **role of private enterprise** – is most effective in things which respond most directly and immediately to the needs of the market place and the consumer (assuming that a market is being created for information services), undertaking marketing and active distribution, repackaging to meet specific needs, providing speed and flexibility of response, reacting to new situations with minimal delay, anticipating and assessing potential needs, creating new information products and services, injecting private investment funds to meet opportunities for growth, eg. online database industry;
- **role of libraries** – they assure the preservation of the record; provide points of access to information resources, products and services; and provide a safety valve for information access for society, especially so that the ability to pay does not prevent individuals from getting access to information that they need. They can provide a means for distribution on a less active basis than would be provided by the entrepreneur, provide general information services and signposts to specialist value-added services. Libraries are of course significant market purchasers of information products, as well as being processors and providers of information services;
- **role of government** – to ensure that needs are met and are regarded as important by society as a whole, even though not served by the entrepreneur, providing pump-priming investment in information resources and their creation which are beyond the short-term capacity of private investment, information provision for which it has special responsibility, eg. census, through direct involvement or subsidies to build up the information marketplace.

It is worth saying that in the West these roles are not uniformly agreed or implemented: many believe that government should have a direct role to play in offering information services; there are examples of libraries taking on entrepreneurial tasks; and many lost opportunities through the failure to invest by the private sector. The real policy issue for China is to seek an appropriate balance – of emphasis, priorities and a proper mix of involvement which will change over time as conditions for a viable information industry develop.

Pricing and charging principles

Pricing is one element of marketing. Marketing is planning that focuses on products, place or mode of delivery, the adjustment of the cost/price to market conditions, and promotion to specifically targeted segments of customers. A marketing approach is important to understand the needs and preferences of different groups. Pricing strategies will be determined through the consideration and inter-relation of three elements:

- the objectives of the particular service or product;
- the nature of costs of the function and aims for cost recovery; and

- the nature/level of demand and the market.

If a service is not being used, for example, you could consider altering the service and the way in which it is provided, reviewing the way that the staff are handling the service, promoting the service more effectively, altering the price, or any combination. Ideally the process should start with market research, which would try to find out which services are valued most and analyse user needs, in order to identify what people would be willing to pay most for. This process provides the opportunity to build user expectations and create a better understanding of value on a gradual basis.

There are no simple approaches to pricing: rather, flexibility must be maintained when approaching the issue of pricing information services and products. There are many models of pricing behaviour that can be exploited for their applicability.

Major pricing strategies

A recent survey of charging suggests that there are three major pricing strategies – cost-based, demand-oriented, and competitor-oriented[4].

Cost-oriented pricing involves the following: finding out what costs are involved, and then working out the prices, bearing in mind what percentage cost recovery (or profit) the organization seeks. This strategy is often used by those charging internal customers.

Demand-oriented pricing involves a look at what the market will bear, the perceived value of the service. This often means that more could be charged for a service which is seen as being 'value-added' (as described above), for example, an extra report. It is important to find out what users perceive as being 'value added' and bear in mind what the costs and cost recovery objectives are. Price elasticity, which is how much in absolute terms the customer will pay before declining to take the product or service completely, is also a factor. High price elasticity means that a small change in price will result in a large change in quantity demand.

Competitor-oriented pricing involves an assessment of what competitors are charging to determine pricing policy. The options are to charge the same, to undercut, or to present the service as better in some way, so that more can be charged. If this involves charging internally, competitors might consist of external information brokers, or other parts of the company. It is important to find out about competitor prices, even if another strategy is adopted. It is also useful to find out what non-competitors are charging, but to bear in mind the effect of different market conditions and organizational objectives.

There are various methods used as the basis for pricing and charging. The details of the techniques can be found elsewhere and this summary draws on the work of Olaisen[5]. These include a consideration of marginal costs, overheads, cross subsidy, incremental costs, subsidization, and market demand.

In a market economy, optimal pricing is where a substantial profit is made and this occurs at the cross-point between marginal revenue and marginal cost. Profit maximization occurs, for example where database vendors charge the highest possible average price during peak hours, with rebates during off-peak time. Pricing according to value is another approach, providing for both profit and loss, depending on segmentation by user groups, allowing price discrimination by which groups of users are charged prices that they would be willing to pay. A variation on this is where all groups are offered the same core services, but with different additional services at probably greater prices. Segmentation can also be by type of user (employees, students, research which is publicly funded, consultant work done by employees, etc.), by type of application (public/private national databases, bibliographic/full text databases/numeric data); or by time (day/term or vacation, etc. to spread work over year). Pricing for full cost recovery is where all costs are covered, ie, there is no public subsidy and no profit. This approach requires use to be estimated over a given period and prices set to cover all costs. It requires prices to be completely inelastic otherwise a drop in demand would have serious adverse consequences.

Marginal cost pricing is an approach adopted either where subsidies are agreed, or to encourage maximum use of capital intensive facilities, operating over a range of decreasing costs when installed. There may then be potential problems when prices are increased in that the quantity used tends to drop, with implications for migration to higher levels of cost recovery. An example is the use of one database system for a country, to take advantage of declining costs associated with spreading use over a capital extensive facility. However, this may encourage a monopoly, unresponsive to new market demands. An example of the problem can be seen in Spain where the database industry is fragmented because it has some twelve hosts, none of which is of critical size and each requiring a different access language, hardly encouraging a healthy information industry.

The free distribution of services is where a full subsidy is provided, for example, for the provision of core societal information, where costs are paid through taxation or other central government mechanisms, and the price to users is reflected only in the time and trouble they might incur to acquire the information. This approach is used, for example, where print-based services are accessible free of direct charge through libraries, whereas online equivalents of the information are charged for.

Obviously all of these strategies can co-exist within the same organization, where different services and products will be subject to different objectives and pricing goals: the task for ISTIC and, more widely in China, is to develop a better understanding and agreement through a national information policy of what should be 'public good' and how value-added services can be developed to beneficially exploit such assets.

Pricing strategies for library and information services

Charging for LIS

Traditionally in the UK library services are provided to users without charge. However there are many pressures for change. Rapidly rising costs and a political philosophy which has favoured the privatization of public services, ensure the questioning of the policy of free public services. Users are also more inclined to question the quality of public services and have increased expectations of service delivery. Indeed the whole organization of public services is a matter of debate in Western Europe today and pricing and charging for library and information services (LIS) should be seen in that context.

A widespread belief that no one should be excluded from access to information is fundamental to Western democratic society and fundamental to library identity and particularly to the role of public libraries. Increasingly, however, libraries must be able to differentiate between 'core' services, which can be argued for payment by taxation (or as part of institutional overheads) and others charged for through user fees, enabling some services to be provided at all, the expansion of services, and the improvement of others. This approach makes libraries more aware of their own costs and what users are prepared to pay for. The fee-based approach is normally used only to support a general tax approach, not to supplant it. However, realistically a strict no-fee policy would undoubtedly require the restriction of services and mean that many new services could not be offered at all. This inter-relationship is important in China at this early stage of development of a market economy, particularly because some 80% of information is currently government created and maintained, and to shift from this position is likely to be a long-term development.

Income-generating activities

Most libraries have some opportunity for income generation, but this is often based on a marginal or direct costing basis, and services are generally provided towards the low 'value-added' end of the spectrum. On average about 10% of funding for academic libraries comes from income generation.

A recent survey conducted by the Institute of Information Scientists in the UK[4], identified the following wide range of services charged for by LIS:

- access to the library (for outsiders: charges range from £20 a year (academic libraries) to £50 an hour (highly specialized libraries));
- specialist reprography and photocopying;
- inter-library loans;
- printing from CD-ROMs;
- providing a library service to another client group, eg. academic library contracting to provide services to the health service staff;
- information and research services (mostly charged pro rata by the hour, with a minimum charge; commercially-oriented services tended to charge about £50-£70 an hour);
- current awareness services;
- publications;
- ordering books, managing periodicals (for other departments; charged per transaction or via an annual fee);
- online database services;
- external access to internally produced databases;
- consultancy;
- room hire;
- fax services;
- use of hardware/software;
- training courses;
- overdue books; loans, reservations;
- acting as agent for a publisher or host;
- providing an indexing service for an outside agency;
- information brokerage facility within the library environment.

Corporate sector LIS

The position in corporate sector libraries has generally moved towards internal charging for all services to departments receiving service. Instead of funding the LIS through company overheads, recharging of costs and demand for service is often directly through customer payment. This has important implications in terms of knowledge of costs and how they can be apportioned to different activities and services. It is not an easy task to cost each service, and then price them on an agreed basis, which might be to cover direct costs, to seek full cost recovery, or be tariff-based, or some combination thereof.

Where this approach has been adopted it is a major culture change – users have been accustomed to receiving information 'free' and its perceived value is often low. Now, demand has to be built up through parallel promotion and marketing efforts, with customers taking more care in purchasing, based on their specific needs, rather than as before demanding information on a 'nice to know' basis. The beneficial effect on service is that the LIS often moves closer to the customer and pays more attention to their wishes.

Business Information Services

A particularly common example of revenue generation in LIS is that of business information services, one of the main opportunities seized in the UK by academic libraries. Probably the best known example is that of the London Business School which offers a fee-based service. It charges institutions a £500 annual subscription for which they get three transferrable library tickets; it charges for staff time at £65 an hour, with discounted rates of £50 for corporate subscribers. In addition it charges £20 for daily use of the Library. The service employs three staff, and offers photocopying, online searches, fax transmission, and document supply as well as desk-based research. An established service of this kind may have up to 100-

150 members. Most of the companies from the professional services sector – design, marketing, management consultancy – where often they can recoup information costs from fees charged to clients.

There is caution, however, in the results of research work done to assess the information needs of Science Park companies, mostly small, high tech and service firms[6]. Generally small companies are not information aware, nor is information a priority, as they are too involved in ensuring their short-term survival and profit. However, there is evidence to suggest that information becomes a more important resource as the companies enter competitive markets, begin to wish to export, and also when they need to take longer term view of business requirements, for example to support new financing arrangements.

Within this project a model of **levels of information service** was developed which has wider applicability and may be used to guide pricing. Put simply, as the level increased, there was a perception of more 'added value' and greater tailoring of service: there was a direct correlation between increased level/added value and the companies' willingness to pay. The nearer the information service moved to business consultancy, the greater the fee the company was prepared to pay. The scope of the prototype service included company profiles, business and research contacts, product and technical data, standards and specifications, patents, innovation and design, marketing and market research, statistics, legislation, research and development.

Level 1	advice concerning routine use of the library (free, and free use of library of university if they wished to use it);
Level 2	quick reference queries which can be handled by reference to available resources within approx 15 minutes – time not charged;
Level 3	provision of information where the results are passed to company in their original format, eg. online printout or photocopy of document, with annotations as appropriate – based on direct charges, plus time factor;
Level 4	provision of information where results are reformatted according to the company's needs – direct charges, plus much higher charge for time factor;
Level 5	provision of information where results are presented with some interpretation or value judgement – time charged near management consultancy rates;
Level 6	acting as consultant for organization on information management – consultancy charges, based on hourly and daily rates;
Level 7	acting as consultant for information strategy of a company, as 6;
Level 8	acting as management consultant, as 7 but higher rates.

This model would appear to be a useful framework within a Chinese information policy which seeks to preserve public good information resource investment, build up a healthy database and other information industry, and to encourage the information consultancy business, in a range of guises.

In summary, the greatest obstacle in marketing fee-based information services is the market itself, particularly in business and industry. The market is still quite unresponsive because small firms in general do not recognize a need for information. Even well established services are making very limited profits, often pricing their services only to cover direct costs, and at best to make a contribution to overheads. In the corporate sector information services are moving away from being funded as a central overhead, towards a demand-driven, priced approach.

Pricing strategies in the electronic information services industry

The pricing of electronic information products and services is a topical, fluid and often contentious issue. The fundamental difference between pricing online information and printed information is that printed information is paid for in advance, whereas online information is usually paid for as it is retrieved, or afterwards, when results are delivered. Print is based on one-off charges, regardless of usage levels; online costs are directly related to use. The CD-ROM algorithm is similar to print, but with networking complications which are dealt with below. Information in the following section draws heavily on the work of Hawkins[7], where more detail can be found.

Online database pricing

There are around 4500 online databases, of which only a few are very heavily used: Medline, CAS, Biosis, and Compendex. Most of the long 'tail' of databases are regarded as being below a commercially viable level of use, especially in Europe. The pricing of online database services can be broken down into: charges for the retrieval process, charges for retrieved information, and telecommunications charges.

Charges for the retrieval process of connect time pricing is calculated as a function of the length of time a user is connected to the system. A connect hour is the usual unit for pricing. This has the advantage of simplicity, it can be explained by intermediaries to end users, and search costs can be estimated (within limits). It also accommodates a wide range of databases, requiring no exceptions. However, this approach does have its deficiencies. Length of time does not relate well to the resources used to retrieve information. Search costs vary depending on the load on the system (timing of search); searchers spend more time studying before going online (hidden costs); connect time pricing discourages maximum use of the interactive facilities of the system; and it penalizes slow typists. However, it has generally endured as the standard method of pricing information retrieval services. It tends to be inhibiting, because actual costs are not known until work is completed and dependency on network connection reliability adds another uncertainty.

Technology developments, such as high baud rates for connection and use of microcomputers make connect time pricing rather obsolete. Use of microcomputer features with software packages to prepare off-line search strategies and rapid uploading of a search, combined with rapid downloading for local manipulation at no additional cost to the user, has required pricing modifications to be developed.

Additionally many systems now require the user to pay for information retrieved from the database, or data extraction charges. Hit charges are a form of output pricing and are levied in addition to other charges, for example, a per-item printed charge, either online, at the user workstation, or off-line at the database site. Different charges are normally raised for different print formats. There are often very low-cost formats which allow cheap scanning of data, intermediate formats giving more information, and full formats which contain the bibliographic data, and which bear appropriate costs.

Telecommunications charges are the third pricing element. Generally this involves the use of national telecommunications services and switched networks rather than direct dial to the remote host, which means payment only for a call to the nearest packet network node.

There are several additional elements of database host charges. In some cases up-front fees have been introduced, particularly for specialized and high value files, eg. numeric databanks, market research files, and these can act as a significant deterrent to low use customers. Some hosts have introduced a minimum service requirement, a minimum annual charge, again to deter very low use. There are discount plans, whereby heavy users are rewarded, and similar arrangements are also offered to special groups of users, eg. academic discounts are common in the hope of creating user dependency; training discounts are available, often against special files; and facilities for credit card billing are increasingly available for end-user services, eg. Easynet.

Product 'bundling' or two tier pricing is becoming common, to counter the phenomenon of migration or cancellation of subscriptions to printed products in favour of online access. Special deals are available for hard copy subscribers, providing online access at a reduced rate, and/or discounts on the CD-ROM product. Examples of this bundled approach are provided below.

New pricing initiatives continue to be introduced. They have recently been announced by CAS, Mead and Datastar; and two other online hosts have revealed that they are developing fresh charging systems (April 1993). CAS/STN bibliographic files are now available with a choice of either paying low connect-hour fees coupled with search-term charges, or high connect fees without further charges. Flat rate charging is being offered on BRS. This is introducing the principle of offering users a choice of pricing structure so that they can choose the method which best suits their search style and circumstances. Datastar introduced a minimum annual fee from June 1993, as a deterrent to those who sign up and do not use the system. Time differential charging, offering lower rates in off-peak hours, when the system load is lower, is available from Dow Jones for night and weekend hours.

UK/ISI database service

An interesting new model in UK higher education is the negotiated arrangement to mount the ISI Citation Indices on a university host computer, and then allow universities to access it via the Janet academic network for a flat fee subscription of £5000 a year, enormously increasing end-user access to online information. Over 70 academic library centres have elected to subscribe to the service. Launched in February 1991 usage has grown to 2500 accesses per day, making it effectively the largest online database service in Europe. Priced at £30 per search (the equivalent standard online access rates) it would have a turnover of £22.7m per annum! In reality, if this pricing structure had been in use, these very high levels of end-user searching would quite simply not have developed. The service is designed to be easy for non expert searchers to use and there are plans to link up to a document delivery service from the British Library, with payment for photocopied documents being made by individual credit card.

ISI receives 50% of the annual subscription, as well as an original capital contribution, and a key strategic question is how far this new (and successful) service is jeopardizing the future of the ISI printed product. On current evidence libraries subscribing to the online service are cancelling their printed subscription. Also worth noting is that the pricing structure of this new service – free at the point of use to researchers, students and others in higher education – has given a huge stimulus to a new market group for online services, namely individual end-users, rather than information intermediaries.

This kind of model may commend itself to China, where, inevitably there is a limited number of organizations with the experience and track record to become database hosts. Such a model could build on existing achievements, and through negotiated deals, encourage the widest and cost-effective use of both indigenous and imported data sources.

CD-ROM pricing

CD-ROM products have the attraction of functioning independent of any telecommunications infrastructure, and their normal subscription basis of charging provides for unlimited usage for a fixed fee, bringing budget stability and predictability. In many situations this is preferable to online services, with their pay-by-use structure, requiring reliable networking. However, they can be uneconomic for anyone who needs limited access to a large number of different sources.

CD-ROM titles in production number around 3600 (1993 CD Directory). Multimedia titles have increased significantly from 40 (1990) to 800+ (1993) and are mainly geared towards the consumer market. However, the volume of CD-ROM sales per title is still limited, and sales of around 300 at commercial price levels (£500 - £1500) are considered good.

A particularly topical and thorny issue is that of charging for CD-ROM networking. Some CD-ROMs cannot be networked because of technical limitations, other providers are still to work out a pricing structure for networking, so at present prohibit it. In 1992 only 22% of available CD-ROMs had a network price (cf. 13% in 1991). All sides are unhappy with CD-ROM network pricing. There is a great variety of agreements and regulations, ranging from publishers charging an extra flat fee, those pricing by band, to those not charging at all.

Chadwyck-Healey does not charge for networking its CD-ROMs to institutions on a single site, but multiple sites are required to negotiate individually. Dialog OnDisc products have a network price which is twice the normal subscription price, with some including an amount of online connect time within the subscription. SilverPlatter charges reduced fees to subscribe to the CD-ROM for print or microfilm subscribers (50%), cumulative index subscribers (30%), and multi-user charges (2-8 users on network) incur a 15% surcharge. These examples illustrate another trend which is the 'bundling' of products in a pricing structure. Whereas LIS as purchasers often seek to replace print copies with CD-ROMs and /or online database access, the producers are pricing their range of print/CD-ROM/online products to encourage the parallel use of all three media.

Although CD-ROM drive prices are likely to come down, product prices, especially for high value industrial/business applications, are likely to stay high. The costs of CD-ROMs seem to many to be excessive, even before the enormous price hikes levied for networking. There is general interest in making pricing structures for CD-ROMs and online database services more technology independent so that they do not need to be adjusted at every technology change, refocusing charging on the information content, plus cost-based delivery media charges. BIOSIS is discussing this approach.

It is interesting to note that discussion in major existing CD-ROM markets, particularly the USA, is beginning to suggest the potential demise of the format for information services. Major LIS purchasers are unhappy with the clumsiness of networking CD-ROMs and the sheer unsuitability of the format for very large datafiles. An emerging preference is for database leasing, data tapes mounted for online networked access by institutions or consortia, sometimes at a bibliographic utility. However, CD-ROMs are likely to continue to be extremely important where the networking infrastructure is limited.

Emerging products

Other emerging products of the electronic publishing industry raise new pricing issues. A strongly emerging new service is that of CAS-IAS (currrent awareness, integrated article supply service). This is emerging in the context of continuing decline in subscriptions to traditional printed journals and an increasing emphasis on the importance of access to information/documents rather than collecting the material on site. Several suppliers – subscription agents, bibliographic utilities, online database hosts – are now offering a front-end online service for the identification of what is published, linked to a facility for document delivery, at present mostly offered through fax delivery within 24 hours (the price range is £6.70 – £10 per article).

The development of electronic journals is still in its very early stages. There is much resistance by authors in relation to the acceptability of the electronic form for purposes of peer review and tenure. One major networked, refereed journal project is from OCLC/AAAS, namely *Current Clinical Trials*, which is priced at $115 annual subscription with additional charges for local printout and delivery of information. It is perhaps somewhat ironic that the pricing structure is based on the printed journal model, whereas the electronic form is in reality a full-text online database. OCLC has announced two more electronic journals in this mode for 1993. Other examples of networked journals are mostly in the form of discussion lists, ie. non-refereed, some 3,000 now accessible over the Internet, with perhaps some 150 of these being credible electronic titles. These are all free and freely accessible over the network.

Government information

Although going rather beyond the topic of pricing, the special position of government information and the opportunities it provides to stimulate the information market, by encouraging tradeable information, is worth some consideration. This is particularly relevant to the Chinese situation where some 80% of information is currently created and maintained by government and government-funded bodies.

The tradeable information concept has already been discussed. In the UK in 1983 the ITAP report[1] included a recommendation that 'government should recognize the current economic significance of the tradeable information sector, and enhance the opportunities for future growth, and take its interests into account in policy formation' (para 6.5), and also 'we would give prominence first, to the stimulation of the UK industry through the release of Government-held information...'

The thrust of subsequent policy development has focused on the supply of government held information to private sector concerns who will create public access information retrieval services as a result. Benefits are perceived as including access to a wider audience, provision of more information from limited public resources, multiple formats of delivery, lack of public risk capital, and new know-how, especially technology and marketing.

Guidelines already referred to[2], now exist for all government departments to follow. The first step to policy implementation is for departments to identify, scrutinize and measure their information holdings – there are techniques to do this as part of information systems strategy development. Guidelines for the basis of exploitation are laid down. Departments should aim to charge a reasonable market price where an established market for this information exists; information not previously exploited may initially be supplied to the private sector on the basis of charging only for costs incurred over and above those that would be incurred for the Department's own purposes, allowing scope for gradual price increases until a full market price is being charged.

The private sector should finance much of the work of extracting and processing information. The Department is advised not to involve itself if the private sector can do it, nor to provide a service on an uncommercial basis where a similar service is provided by the private sector. Generally the guidelines suggest that Departments should seek non-exclusive agreements, or exclusive agreements only after open competition. The approach has taken over ten years to move this far, but is now extensively followed by major government departments.

It is particularly timely for such a policy to be developed in China, as already joint ventures are being entered into[8]. The need for fair and reasonable arrangements to be struck, so that the indigenous database creation activity can thrive through re-investment of royalties, for example, is critical to the country's information policy formulation.

In the USA the policy of trade in government information has been implemented for over a decade – the default is for a private sector information service from government information unless there are compelling reasons for government intervention, in the public or national interest. A market-based approach raises some fundamental questions:

- whether the government should act as wholesaler or retailer of information;
- does open availability of information mean it must be free;
- what are appropriate forms of public access – online, limited interaction, availability at national centres, depository libraries, etc;
- what mechanisms are available for active exploitation of these information services eg. libraries to make governmentally distributable information available to the public;
- should the public be expected to pay a second time to have access to information whose cost of collection has already been met out of the public purse;
- what information is of too much importance to be left to the vagaries of the marketplace?

Summary of key points

A healthy information industry requires the systematic development of a technological infrastructure, particularly pervasive networking.

The creation of an information marketplace is a long-term strategy. It is dependent of valuing information as a commodity, and this culture is often slow to develop, even in market-based economies.

The use of information as a strategic resource requires senior level commitment. The government can play an important role in the way is handles its own requirements and initiatives for pump-priming necessary private sector investment. Policy on government information can be used to provide a special opportunity to stimulate the information marketplace, and encourage the involvement of the private sector in a range of value-added services.

Experience suggests that free information services are often perceived as low in value. The notion of 'adding value', especially through IT opportunities, is an important one. It often suggests different levels of service, with different pricing and charging policies. Tradeable information is becoming a more understood concept, but it has taken a long time to be accepted in the West and there is still a low level of information awareness in many small companies. The notion of charging for information is a very political one, and there is no Western consensus on the right balance between free and fee.

It is important that freedom of access is not confused with free access – it is primarily about different ways of funding and paying for use. It is also possible for the information industry to be used for public good provision.

Pricing must be seen as part of the wider issue of marketing and should not be considered in isolation. There is a tri-partite relationship between the objectives of an organization, the behaviour of its costs, and the nature of the market. All three need to be part of any pricing consideration, and all will change over time.

Pricing strategy is complex. There are many methods – cost, demand and market-oriented, each suiting different times, products and services, and political circumstances.

There are opportunities for revenue-earning in most public sector and higher education LIS. Services tend to be priced on a recovery of direct costs and contribution basis, not to distort primary service objectives, and are mostly at the low end of the added-value spectrum.

There is an increasing trend for institutional LIS to charge out their services to internal departments, primarily to recover costs, but also to encourage better value for money, an appreciation of user requirements, and a direct understanding of the value of information to the business.

Pricing for electronic information services is topical, fluid and often contentious. Publishers and providers are still uncertain of the economic implications of products co-existing in online, print and CD-ROM form. They are offering 'bundled' prices in an attempt to sustain and increase revenues.

Online database pricing is complex and changing. The industry is trying to shift pricing structures from a dependency on the technology platform towards charging for the information content, regardless of delivery mechanism.

In the CD-ROM marketplace there are particular problems associated with the price for networking. Some are questioning how long a future the CD-ROM information product has.

Emerging services such as CAS-IAS and electronic journals are still in the experimental stage, with different players cautiously entering the marketplace. It is too early to have solid evidence of market or pricing issues.

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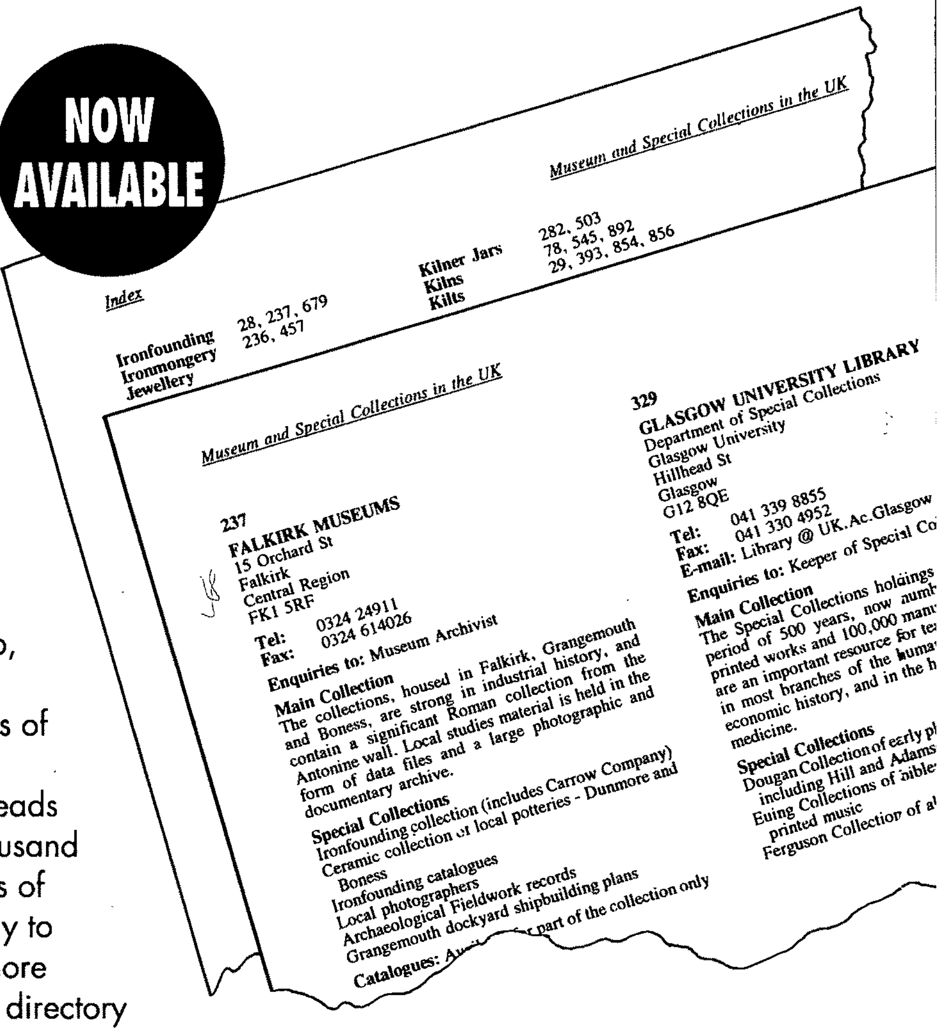

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